

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. III

DECEMBER, 1924

No. 6

ROENTGENOGRAPHIC TYPES OF SARCOMA OF THE LONG BONES¹

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THE successful treatment of malignancy is dependent on early recognition and eradication; sarcomas of bone are prone to show certain features roentgenographically, which, when properly interpreted, make early diagnosis possible and thus afford the opportunity of improving the present discouraging results. By correlating the roentgenographic findings with the history and clinical findings, a large percentage of correct diagnoses is possible without surgical intervention. The site, size and origin of the tumor, and often the structural type, may be determined by an experienced roentgenologist. The first evidence of pulmonary metastasis is found in the roentgenogram, long before clinical examination discloses its presence. Thus, for the early detection of sarcomas of long bones, clinicians and surgeons are dependent on roentgenographic interpretation. Improved results may come with closer co-operation of clinicians, surgeons, and roentgenologists. The physician, unless experienced in roentgenographic interpretation, should not make a diagnosis or advise radical surgery from the roentgenogram alone. In my opinion, it is practically always advisable, before sacrificing a useful limb, to apply a tourniquet so that the gross and microscopic characteristics may be considered and the pathologist's opinion obtained.

In this review only those cases were considered in which the history, clinical and

roentgenographic examinations, operation, and microscopic examination were made at the Mayo Clinic. Thus it may be considered that the material was thoroughly examined and proved microscopically to be sarcoma; in many instances the final proof, pulmonary metastasis, corroborated the diagnosis. Benign giant-cell tumors are not considered.

Bone sarcomas are commonly spoken of as central and periosteal, and sclerosing and rarefying types may be recognized roentgenographically. Although considerable variation appears in the roentgenograms of these malignant bone tumors, these types may be recognized with reasonable accuracy. Certain tumors involve medulla, cortex and periosteum; thus a central sarcoma may be seen at different stages, first appearing as a malignant cyst, involving the medulla, and later destroying cortex and periosteum. Further, central sarcomas may be sclerosing or rarefying, and both types may later invade periosteal structures. Likewise periosteal-appearing growths may be found, on section, to invade the medulla.

The most characteristic type of long bone sarcoma, roentgenographically, is represented by Figure 1. A spindle-shaped swelling appears in the diaphysis which has apparently pushed out the periosteum by tumor growth; fine lines of bone resembling sun-rays are laid out in the substance of the tumor. The outline of the tumor is dis-

¹Read before the Radiological Society of North America, Chicago, Illinois, June, 1924.



Fig. 1 (Case A309655). Sun-ray appearance in an osteogenic sarcoma of the shaft of the tibia. Apparently the tumor arises from the periosteum.

The patient, a boy aged sixteen years, came to the Clinic March 20, 1920, complaining of a swelling in the left leg. Nine months before, a horse had fallen on his left leg. Pain had developed, and more recently swelling and a limp. The patient's general health was excellent. Examination revealed a hard, nodular tumor of the left calf, with local heat. The left calf was slightly enlarged. The left knee flexed to 90° , and extended to 170° . The pulse was 104, and the temperature 99.6° . The systolic blood pressure was 134, and the diastolic 92. The roentgenologic diagnosis was sarcoma of the upper half of the tibia. The thigh was amputated March 27, and radiotherapy advised. The patient returned home, wearing a Pilon stump, but did not take radiotherapy. He wore an artificial leg, and was up and around, until a month before his death, which occurred June 7, 1921. Roentgenograms taken May 21, 1921, revealed pulmonary metastasis.

tinct, because of the bone deposit of the osteogenic type, producing a solid tumor and bulging periosteum. This type is easily recognized, and benign growths rarely simulate it. In this type irregular masses of bone may appear beyond the cortex without the sun-ray appearance (Fig. 2). The shaft appears clear or slightly irregular, and although the medulla does not seem to be affected, examination of the specimen will show that it is in all late cases.



Fig. 2 (Case A290902). Here the outline of the shaft can be plainly seen, and although there is an osteogenic sarcoma producing invasion, the sun-ray appearance is lacking.

The patient, a woman twenty-seven years of age, came to the Clinic September 26, 1919, complaining of swelling and stiffness in the right knee, of eighteen months' duration. Arthritis had been diagnosed, and tonsillectomy performed elsewhere. The swelling had continued, but more slowly, and with less pain than at the time of onset. The patient had lost weight and strength. A hard tumor, extending from the middle of the femur to below the knee, and a large hard mass in the right axilla were found. Roentgenograms of the right femur revealed a sarcoma with destruction of the lower half of the femur, and pulmonary metastasis in the base of the upper left lobe. The case was considered inoperable. The patient died about a year later.

Another characteristic roentgenographic type is the sclerosing, which presents a central mass of increased density at the end of the shaft, usually involving the epiphysis, and at times invading periosteal structures with dense, irregular bone masses. The entire bone is involved, so that the X-ray shows no difference between cortex and medulla (Fig. 3). A sclerosing sarcoma of the shaft with sun-ray appearance in soft tissue without lifting of periosteum or widening of the shaft may also be seen.

A periosteal type apparently not involving the cortex, but causing pressure absorption, is illustrated in Figure 4. This tumor appears to involve only one side of the

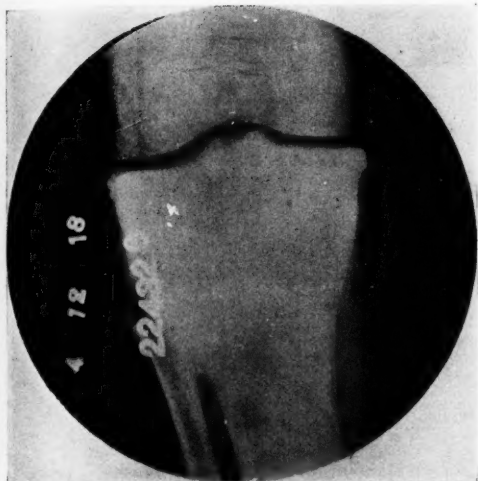


Fig. 3 (Case A224326). The sclerosing type of sarcoma without differentiation between medullary and cortical bone.

The patient, a man aged twenty-three years, came to the Clinic March 6, 1918. He had been treated for "lockjaw" which had followed ulceration around a tooth six months before. A month after this he had noticed a swelling without inflammation in the upper left tibia, and pain incapacitated him. There was no history of trauma. Roentgenograms revealed marked density in the upper left tibia. A specimen was removed, and the pathologist suggested syphilis. However, the Wassermann reaction was negative, and intensive treatment for syphilis for three weeks failed to benefit. Amputation was performed, and further microscopic study proved that the growth was a mixed-cell periosteal sarcoma. Radiotherapy and Coley's toxins were advised. Nine months later there was metastasis to the lungs and left hip, and death occurred a year after operation.

bone, and is apparently unable to form bone, the body of the tumor appearing as a rarefied mass (round-cell sarcoma). In a somewhat similar type a tumor may surround the shaft and invade the periosteal tissue.

The central sarcomas appear to perforate the cortex at times, and produce tumors of considerable size which would slightly resemble osteochondrofibromas (Fig. 5). The large bulky tumor shown in the figure originated in the lower end of the diaphysis and involved the epiphysis, but not the cartilage of the joint; it perforated and produced a firm encapsulated tumor of variable density. The patient died from metastasis.



Fig. 4 (Case A339571). Periosteal type of sarcoma which was apparently causing absorption of the cortex.

The patient, a university student aged twenty-three years, came to the Clinic November 1, 1920, because of a painful right shoulder. He had been injured two years before, in a football game, and again eight months before examination, and had been treated for an impacted fracture. Examination showed enlargement of the right shoulder and the upper third of the humerus. The roentgenologic diagnosis was sarcoma of the humerus. December 3, the tumor was excised, and a radium pack inserted. August 22, 1922, several small sequestra were removed as there was a persistent sinus. May 18, 1923, the patient had a pathologic fracture, and exploration with removal of bone was undertaken. August 22, the right humerus was disarticulated at the shoulder, together with a deltoid muscle which was found to be involved. The pathologist's report was mixed-cell sarcoma. The patient was given intensive radium and X-ray treatment, and is living and apparently well at the present time, four years after examination.

Central tumors may resemble cysts, or appear sclerosed. However, there is a distinct group, characterized by rapid destruction of bone in all directions, with perforation of cortex and periosteum, and invasion (Fig. 6). At times these rarefied types seem to arise in the cortex and involve one side of the shaft, and an invasion may occur at this point.

I have seen certain sarcomas in which the production of bone has been so great as to render it impossible to make out the point of origin, or to see any sign of the shaft, but in which the roentgenogram demonstrates large tumors of the osteogenic



Fig. 5 (Case A268392). Sarcoma arising in the cancellous bone, perforating posteriorly so as to form an encapsulating tumor.

The patient, a man aged twenty-five years, came to the Clinic April 21, 1919, complaining of a tumor of the left thigh. Eight months before, he had bumped the lower left thigh, and a month later swelling and soreness developed. The swelling slowly increased. Roentgenograms had been taken elsewhere, and the condition diagnosed sarcoma. Examination revealed a tumor 15 by 20 cm., just above the popliteal space, with local heat and engorged veins. The diagnosis of sarcoma of the lower third of the left femur was made from the roentgenogram. With a tourniquet applied, the tumor was explored, and found to arise in the medullary substance. It was apparently encapsulated, and easily shelled out. The pathologist's report was "cellular osteofibroma with secondary hyperplasia (sarcoma?)." Radiotherapy was advised. The patient returned nine months later with local recurrence, and amputation was performed. The pathologist's report was sarcoma. Radium and X-ray treatment were given. The patient was operated on elsewhere, August 1, 1921, and died three days later, apparently from shock.

type replacing and obscuring all structures of the part.

Occasionally the roentgenogram of sarcoma presents the picture of destructive arthritis (Fig. 7), probably owing to extension through the capsule of a periosteal tumor.



Fig. 6 (Case A248616). Central sarcoma which has perforated into the axillary space.

The patient, a man forty years of age, came to the Clinic October 14, 1918, because of a painful tumor of the right humerus. About three months before, he had had sudden pain and stiffness in the neck and right shoulder. This improved until after a military drill, when severe pain developed in the right shoulder. A roentgenogram had been taken, and malignancy diagnosed. Examination disclosed a tumor of the upper right humerus, with atrophy of the shoulder muscles. Roentgenograms revealed a large cystic mass, probably malignant, in the upper humerus. Resection of the upper humerus was performed October 18. Radium and Coley's toxins were administered. The patient died from metastasis in June, 1919.

In post-operative roentgenograms sarcoma may simulate osteomyelitis with sequestra, especially when infected.

These types are the most common and are presented briefly without discussion of their relative malignancy and metastasizing power. The type of cells, the relation to trauma, the age and life expectancy have been reviewed in a previous paper.² Although it is usually possible to diagnose sarcoma of the long bones from the roentgenogram, the history, clinical, and laboratory findings should also be carefully considered.

²Meyerding, H. W.: Sarcoma of the long bones. *Burg., Gynec. and Obst.*, 1922, XXXIV, 321-332.

DISCUSSION³

DR. JOSEPH COLT BLOODGOOD (Baltimore, Md.): In central tumors we are helped somewhat by age, location in shaft or epiphysis, and the bone involved. With rare exceptions, the bone cyst or osteitis fibrosa is observed in the shaft at ages under eighteen, usually under fifteen, and very frequently from five to twelve years of age. Involvement of an epiphysis with osteitis fibrosa is very rare, and is usually seen in adults. The bone cyst may attack any bone,—it is most frequent in the long pipe bone.

The giant-cell tumor, with the rarest exceptions, is observed in the epiphysis after the age of twenty and most frequently between twenty and thirty. Central sarcoma of bone is very rare. In my experience there are two chief types—one a sarcoma developing in a pre-existing chondroma or chondromyxoma, the other the bone aneurysm which is a malignant hemorrhagic cyst. When one observes a central tumor in the shaft of an adult, beware of the myxoma or the chondrosarcoma, and be prepared to deal with it accordingly.

There is, therefore, no positive method for differentiating the various types of central tumors in the epiphysis of the bone of an adult—the probabilities point to the giant-cell tumor, but any benign or malignant type of tumor may occur. If the central tumor is in the shaft of an adult, as stated before, it is probably a chondroma, myxoma or sarcoma.

When the patient is under fifteen years of age, practically all central tumors of the shaft are the benign bone cyst. If the epiphysis is involved, it is probably a giant-cell tumor.

The Bone Shell. The remarkable feature of all central tumors of all types and at all ages when first seen in the X-ray is the absence of any bone formation in the periosteum covering the bone shell and the absence of ossification within the bone shell.



Fig. 7 (Case A367850). Sarcoma arising from the periosteum, involving the knee-joint and giving the appearance of destructive arthritis.

The patient, a farmer aged thirty-nine years, came to the Clinic August 9, 1921, because of disabling pain in the right knee, necessitating the use of crutches. He recalled injury to that knee eighteen years before, and had had more or less pain ever since. He had had two operations without benefit, after which he went sixteen years without treatment. Then, following influenza, the knee had swollen and a third operation had been performed. This benefited him for a year and a half, then the knee became much worse, and crutches were required. He had been unable to work for two years. On examination the right knee was swollen and tender, with flexion of 160. The roentgenologic diagnosis was destructive arthritis with considerable synovial thickening. Amputation was performed August 13, 1921. The pathologist reported mixed-cell periosteal sarcoma, originating in the periosteum on the posterior surface of the lower femur, and invading the articular surface, and the cancellous tissue of the femur, tibia, and patella. March 12, 1924, there was evidence of pulmonary metastasis. The patient is still under treatment.

Ossification of the bone shell, giving it a thicker and irregular appearance, has, in my experience, been associated always with a chondroma. Ossification of the central area with no history of operation, injury or X-ray treatment is seen chiefly in osteitis fibrosa, and now and then in metastatic carcinoma.

Destruction of the Bone Shell. Partial or complete destruction of the bone shell

³See November *Radiology*, p. 389, for discussion of Dr. Meyerding's paper as grouped with other papers.

with a roentgenogram showing the tumor shadow still circumscribed and, on palpation, no infiltration of the soft parts, is seen chiefly in the benign giant-cell tumor. When the rare central sarcoma destroys the bone shell, it usually perforates, infiltrates and produces a definite periosteal tumor.

Perforation of the Bone Shell. I have seen this in the bone cyst, the chondroma and the myxoma. There is no means of differentiation.

Fracture. This is most common in the bone cyst, next in the metastatic tumor, least frequent in the giant-cell tumor. I think this has more to do with location than pathology. Pathological fractures are more common in the shaft than in the epiphysis. With the rarest exceptions ossification follows rapidly after fracture in the bone cyst. In the few examples of fracture in the giant-cell tumor, I have never observed ossification. In the other types of bone tumors ossification may take place after fracture, but it is unusual in the malignant, whether primary or metastatic.

Now and then the metastatic tumor, when it is a single lesion, gives a very characteristic picture—there is no definite central light area surrounded by a bone shell, but the involved area looks like osteoporosis. This is a common picture in metastatic carcinoma. Metastatic hypernephroma produces a honeycombed or spongelike area.

Method of Attack. In individuals under fifteen with involved shaft, with or without fracture, operation is not indicated, unless further roentgenograms show no evidence of ossification or an enlargement of the light area. These are the cases which, if left alone, lead to deformity and make subsequent treatment more difficult. At the operation, one explores: If it is a bone cyst, the treatment is fracture, best crushing of the bone shell. There is no objection to removing the fibrous tissue within the bone shell. If it is any other pathological process, do not fracture or crush, but burn out with the cautery.

If the epiphysis is involved and the patient is under fifteen, give X-ray treatment—it may help the giant-cell tumor. If ossification does not take place, or the tumor becomes larger, explore and, no matter what the pathology is, thoroughly curet with the thermal cautery.

In individuals over fifteen not much is gained by delay. There is no objection to giving X-ray treatment. The majority of the tumors will be in the epiphysis and of the giant-cell type. But there is always the possibility of a chondroma or a myxoma or a rare sarcoma. I have had no cases yet to prove it, but I feel fairly confident that if we, in operating, always have at hand a number of red-hot soldering irons, we may accomplish a cure in an early myxoma or sarcoma with an intact bone shell. There is no question, of course, about the cure in the giant-cell tumor and the chondroma.

Periosteal Lesions. These are characteristic in the X-ray. There may be bone formation outside the shaft, or there may be only a tumor shadow. The periosteal tumor, whether bone or not, is palpable. There may or may not be destruction of the cortical layer. The shaft beneath may be normal, show osteoporosis, definite destruction, or sclerosis. The marrow cavity shadow may be normal or not. The practical point is this: In some cases we can say from the X-ray, combined with palpation and the history, that this is a benign exostosis, this is ossifying myositis, this is ossifying traumatic periostitis, this is sclerosing sarcoma, this is destructive sarcoma, this is non-suppurative osteomyelitis, this is Paget's disease, this is tuberculosis, this is syphilis, this is suppurative osteomyelitis with a sequestrum and involucrum. In this group age, position on shaft or epiphysis are not helpful. The involvement of a phalanx is. Malignant bone tumors do not attack the phalanges.

The practical point to remember is this: Definite records show that in some bone lesions of the periosteal group there is no way in which a diagnosis can be made with-

out exploration, and there is no indication for exploration unless you have made up your mind to resect or amputate, if the lesion proves to be malignant. The differential diagnosis at the exploration is not a simple affair, and there is nothing gained by any inexperienced group undertaking it. In these periosteal lesions, my feeling is, the patient should be given intravenous salvarsan, even when the Wassermann is negative; then there should be deep X-ray therapy, and if there is no beneficial result, operation must be considered—exploration, resection or amputation. One must bear in mind that sarcoma is rarely cured by amputation below the middle third of the femur, and never above, and never in the upper extremity. When the involved area is a bone which can be readily resected without loss of function, or resected with bone transplantation and fair function, this should be the operation of choice.

It is to be remembered that in the past there have been many unnecessary amputations with but very few sarcomas cured by amputation. Little is lost to-day by postponing amputation, except in undoubted cases of sarcoma in the lower extremity involving the lower end of the femur or the upper end of the tibia, or areas of bone anywhere which can be resected with restoration of function with or without bone transplantation.

DR. H. W. MEYERDING (closing): I have tried to show some of the roentgenographic types of sarcoma met with in our

work. These patients were selected for illustration because most of them have developed metastasis or have died; there can be little question as to the diagnosis. I do not know whether the primary tumor observed caused metastasis, or whether the metastasis is a secondary growth; I believe, inasmuch as metastasis occurs regularly in the lungs, that it is secondary to the primary tumor in bone. Before sacrificing an extremity, it is best to apply a tourniquet, and have a pathologist's opinion to corroborate the diagnosis. There may be exceptions to this rule, especially when joints are badly damaged, or the tumor has attained a size where any sort of conservative surgery is out of the question. Amputation is, of course, often done as a palliative measure. I believe it worth while as it allows the patient a measure of relief which may extend into several years, free from the tumor growth, pain and disability. I do not believe that exploration of the tumor under tourniquet has anything to do with metastasis, since metastasis takes place in cases of tumors not operated on.

I am presenting here roentgenograms representing the most common types of these cases.

In a paper published in *Surgery, Gynecology and Obstetrics*, March, 1922, I have discussed the relation of trauma to the type of cell, the relation of age to location, the relation of type of cell found to duration of disease, and the results of 109 operative cases.

THE GENERAL ASPECT OF TUBERCULOSIS AS PRESENTED BY X-RAYS¹

By JOHN D. MACRAE, M.D., ASHEVILLE, N. C.

INTERPRETATION of chest films is not satisfactory, though this is not the fault of X-rays. It is directly chargeable to lack of experience and lack of study on the part of physicians doing X-ray work.

After making a careful physical examination and study of the history in a given case the internist believes certain pathological changes exist. The radiologist studies his films and thinks that peculiar shadows represent definite lesions. Postmortem examinations discover our weakness or strength.

All men interpreting chest films should make it a custom to confer with the internist, who also examines the patient, and compare notes on every case, and also seize every opportunity to examine lungs post-mortem with X-rays and by cutting the prepared specimens. By this means only may they become proficient and have their opinions respected. If such a system of conferences is an established routine with the clinician and radiologist, it becomes reasonable to read into the interpretation an opinion as to whether a given case of pulmonary tuberculosis is "active" or "inactive." A diagnosis can be made and a prognosis expressed.

What I have to say may seem trite or elementary, but I am giving general impressions formed in studying thousands of cases of tuberculosis with X-rays, holding conferences with many different physicians who are familiar with the patients through physical examinations and history-taking, and also by postmortem examinations on a few hundred of these patients who have died.

Do not attempt to localize a certain disease process, but describe the various densities recorded in the stereoscopic films. Avoid arriving at a diagnosis by any other means than X-rays. In summarizing, you will probably recognize a certain density

as representing a certain pathological entity.

Our interpretations of the films of tuberculous lungs are based on our knowledge of lung anatomy and the relative densities of the various pathological processes common in this disease. In pulmonary tuberculosis the greatest density is calcification, next caseation followed by fibrosis and infiltration, and then exudates. The cellular exudates in tuberculosis are probably heavier than in simple pneumonia.

We know that healed fibroid tuberculosis in the apex of an upper lobe is often found at X-ray examination, when the patient gives a negative history as to having ever been sick with tuberculosis. In such a case physical examination will show slight flattening over the upper chest on the affected side, diminished resonance, a narrowing of Kronig's isthmus, and broncho-vesicular breathing, the signs varying in intensity with the extent of involvement. If the clinician finds no more signs and symptoms than above described, he is justified in making a diagnosis of "chronic inactive fibroid tuberculosis." Now if I examine such a case, I describe the changes thus: "The chest is slightly retracted over upper right side. There is a small, dense, circumscribed shadow in the upper hilum on this side and the vertebral trunk leading from it is thickened. The terminal branches of this trunk are seen as linea markings, reaching the pleura within the circle of the first rib. No other striking changes are noted in these lungs. Discussion: The retraction has resulted from a contracting lesion in the right apex. The dense shadow in upper hilum is a calcified node, and the thick trunk with linea markings to the periphery represents fibrosis. Diagnosis: Chronic inactive fibroid tuberculosis. Prognosis: Excellent."

¹Read before the Radiological Society of North America, Chicago, June, 1924.

I have recently had such a case. The man was asthmatic and while in the hospital his asthma and old tuberculosis seemed unrelated. He died from taking an overdose of morphin. Postmortem findings were in direct accord with the clinical and X-ray interpretations. The case is cited to illustrate method of comparing clinical and X-ray findings with postmortem findings and to justify the discussion of "activity" and the expression of a prognosis. I believe the radiologist who studies many lung cases should express opinions on these two points and be able to defend them.

Cavitation is preceded by caseation, the caseous material liquefies and is thrown off by coughing. In favorable cases the cavity walls become firm, thick and fibrous and may so contract as to obliterate the cavity entirely. Or the ulcerative process continues to destroy tissue, firm walls do not form, and the cavity expands until a whole lobe may be represented by a cavity, nothing being left except the pleura. In such cases I have seen visceral and parietal pleura glued together against the thorax so that the lesion was mistaken for pneumothorax. A cavity may be small and centrally located, hidden from the examiner's stethoscope by a thick layer of normal lung between it and the chest wall, and only recognizable by X-ray examination.

The sounds of amphoric breathing and whispered pectoriloquy may be transmitted along a band of fibrous tissue from a large bronchus to the periphery and simulate cavity when the X-ray fails to show it, and no cavity exists.

I have never failed to find cavity at postmortem examination when I had diagnosed cavity with X-rays previous to death; nor have I ever recognized the annular shadow at postmortem which had previously been described as the result of localized pneumothorax between visceral and parietal pleura or in the interlobar fissures. I am satisfied that annular shadows from the above causes exist. I occasionally describe them. When they are found their location is apt to be close to the hilum, rather than in the upper

lobes, and some distance out from the lung roots. Cavities are seldom seen in the hilum regions unless massive lung destruction has taken place, and cavities are found in other parts of the lung first. Another point is that caseation and infiltration are not apt to mark the lung immediately surrounding the localized pneumothorax.

I have seen the small, well-defined, circular shadow representing a transverse section of a bronchus mistaken for cavity.

Caseous bronchopneumonia is found very often in the middle part of the lung opposite the oldest lesion. Its appearance in X-ray films is characterized by thickened trunks, which are accompanied by numerous points of density about them,—to use Dunham's expression, they look like "raisins on a stem." If such a lesion is examined postmortem, the cut surface of the lung will show numerous caseating conglomerate tubercles with areolæ of pneumonitis surrounding them.

To my mind the process which produces such lesions is one of retrogressive lymph flow, the lymph bearing tubercles from a hilum node which is secondarily infected from the older lesion. This is essentially a tuberculous lymphangitis, or "peribronchial tuberculosis." When the rupture of the engorged lymphatics takes place there is dissemination of infectious material into the parenchyma and we have caseous bronchopneumonia. I do not like the term "peribronchial tuberculosis," because it exists generally as a part only of a more important process and also because it is erroneously offered as a diagnosis in the presence of generalized thickening of trunks radiating from the hilum and which could as well be related to some other pathological condition as to tuberculosis.

It is rare, if ever, that a tuberculous lesion is found at the base of the lung on either side, unless there is evidence of a lesion, old or recent, in one or other upper lobe at the apex.

Recently a search of the records at Oteen Veterans' Bureau Hospital disclosed the presence of four cases of "basal tubercu-

losis," among a thousand cases. These were critically studied and although they seemed at first to be purely basal tuberculosis, they proved to be accompanied in each instance by some evidence of healed apical tuberculosis of very small proportion.

One of our most difficult problems in interpretation is the valuation of the changes at the lung roots.

In children, lymphadenopathy at the hilum may be the result of any infantile disease or it may be tuberculous in origin. It is absolutely necessary to determine all clinical factors in making the diagnosis. Of course, lymphatic involvement in children is the route of tuberculous invasion and therefore hilum involvement is the common type of tuberculosis in children. It is also true that if pulmonary involvement occurs it will probably be the result of a damming up of lymph channels in the lungs, as they reach the involved hilum lymph nodes and the secondary backward extension into the lungs.

Capped trunks represent the arrested processes which occurred in childhood and which we see quite often in adults.

In adults, hilum tuberculosis, according to my observation, has generally been secondary to bone or abdominal tuberculosis. Hodgkin's disease and lymphosarcoma may simulate it.

Caseous tuberculous pleurisy is a most interesting condition, which is occasionally seen. In my experience I have studied about thirty cases. They are characterized by rather rapid progress after an obscure onset, with pleural effusion in some. They were at first diagnosed only at post-mortem examination. Later we came to recognize a few from the X-ray films. The men in whom this condition developed were negroes, who had lived in the woods and never in crowded districts, and some white men from lumber camps of the Northwest, who likewise had not been exposed to tuberculous infection in childhood. These patients, contracting their disease after having reached manhood, were not protected by the immunizing effects of small early infections, and, therefore, their defensive reactions were most unusual. Similar cases have been described by French and German physicians among Arabs and soldiers from Algiers.

SUMMARY

Interpretation of X-ray films of lungs is to be improved by conferences with clinicians and frequent postmortem studies.

The radiographic findings and those of the internist must always be considered together. If there is a discrepancy between the two examiners' findings, it should be explained by re-examination.

Uterine cancer.—Report of results on cases treated from 1918 to 1921, using the "bomb" container devised by Dr. Harold Bailey for application of gram of radium. Treatment consists (1) of insertion of cervical tandem into uterine canal, the cervical capsule being twice the strength of the one at the internal os, total dose being 3,000 mch.; (2) vaginal application of the bomb containing 1,000 mc. of emanation, with total dosage of 3,000 mc. hours against vaginal vault; (3) external irradiation of pelvis with block applicator at 4 cm. distance, total external dosage being 9,000 mc. hours. This is sometimes augmented by insertion of bare tubes of emanation into isolated nodules. Late in 1921, the external radiation was supplanted by X-ray,

using 140 KV., 12 in. distance, 5 mm. Al., 5 ma. current, for 15 minutes to each area of about 8x8 inches, over four areas.

In primary advanced cancer of the cervix, twenty-six cases, or 9.2 per cent of total number in the group, are alive and well after three years.

In the borderline group, all with some extension beyond the cervix, 20 per cent have survived three years or more.

Of the twenty-six early operable cases treated by radiation, eleven, or 42.3 per cent, are alive and well.

W. W. WATKINS, M.D.

Treatment of Cancer of the Uterus with Radium and X-ray. William P. Healy. Canadian Practitioner, March, 1924, p. 161.

STUDY OF MILIARY TUBERCULOSIS BY SERIAL RADIOGRAPHIC EXAMINATION

EVIDENCE INDICATIVE OF CHRONIC FORM, AND SUGGESTIVE OF A HEALED FORM¹

By L. R. SANTE, M.D., F.A.C.P., Associate Professor of Radiology, St. Louis University School of Medicine

MUCH has been learned concerning the symptoms, course and clinical forms of miliary tuberculosis from clinical observations and autopsy findings. Two forms of the disease are recognized, the general and the local. In the former, the general features predominate, the patient presenting evidence of an overwhelming intoxication, with prostration, rapid pulse and high fever; this is often called the "typhoid type" owing to its resemblance to that disease. In the latter, the local symptoms predominate. Three special forms of this type have been described—the pulmonary, peritoneal and meningeal. Such a division is purely arbitrary; more than one type may be present at the same time.

The cause of miliary tuberculosis is generally accepted to be the rupture of a previous tuberculous focus, such as a caseous lymph gland, into the general circulation, thereby disseminating tubercle bacilli throughout the system. Where the dissemination is general all organs are involved, and the generalized type of disease results; where the bacilli enter the venous circulation they will reach the lungs, and the pulmonary type results. In like manner the portal or abdominal circulations or the meningeal blood vessels may be involved, giving rise to the peritoneal or meningeal types.

Radiological examination has substantiated these findings. The present report is based on a radiographic study of fifteen cases of miliary tuberculosis occurring at St. Mary's Hospital, St. Louis, and the St. Louis City Hospital during the last five years; both generalized and localized types were encountered.

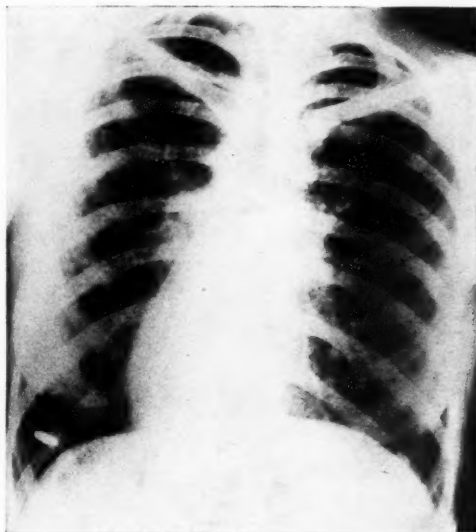


Fig. 1. Typical miliary tuberculosis showing the uniform distribution of minute soft infiltrations (Adult).

In the generalized type, where all of the organs of the body are involved, the lungs will be seen studded with minute infiltrations, uniformly distributed in the apex and the base. Miliary tubercles cannot be visualized radiographically, but the conglomerate tubercles which are soon formed are readily recognized and are the lesions which give rise to the characteristic radiographic picture (Fig. 1). Serial radiographic examinations, or plates taken at intervals during the course of the disease, reveal, at first, only minute infiltrations, here and there in the lung field. These increase in number and rapidly become larger, but they never attain the size of the infiltrations encountered in bronchopneumonia, and rarely become confluent. The

¹From the Departments of Radiology of St. Mary's Hospital and the St. Louis City Hospital. Paper read before the Radiological Society of North America, at Chicago, June, 1924.

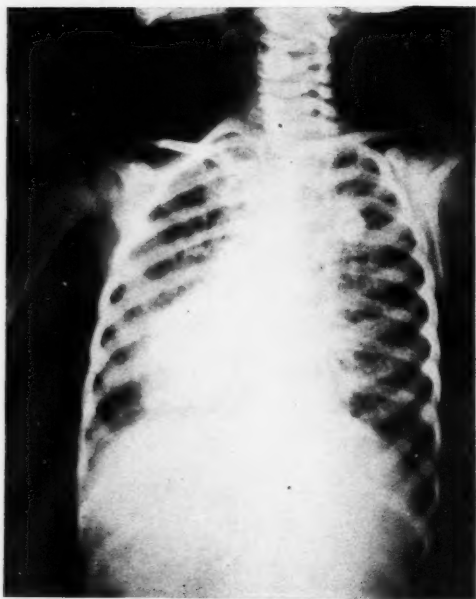


Fig. 2. Miliary tuberculosis in a child eighteen months old. (Autopsy.)

disease may occur at any age, one patient in our series being eighteen months old (Fig. 2).

Where the localized form is of the pulmonary type, the lesion is likewise readily recognizable, but where the peritoneal or meningeal types occur, the diagnosis is im-

possible from the radiograph. Under these conditions the chest film shows no evidence of abnormality, yet the patient may be suffering with miliary tuberculosis, autopsy revealing advanced involvement of either the peritoneal or meningeal type, without a single demonstrable lesion in the lung (Figs. 3a, 3b, and 3c).

"Occasionally miliary tuberculosis has followed the rapid absorption of a pleural exudate," according to Osler and McCrae. Such an instance occurred in one of our patients.

E. S., white, female, age 24, entered the hospital July 24, 1921, complaining of cough, pain in the chest, and weakness. The family history and past history contained nothing of importance except that she had suffered from pneumonia three times and was known to have had a cardiac lesion for several years. Physical examination revealed evidence of a moderately large effusion in the right chest. This was confirmed by the X-ray, and the patient was aspirated. Following aspiration there was rapid absorption of the remaining fluid, and the patient was discharged from the hospital as cured, October 19, 1921.

On January 18, 1922, she was readmitted to the hospital, complaining of "cough and vague pains in the head, back and extremities." Physical examination revealed

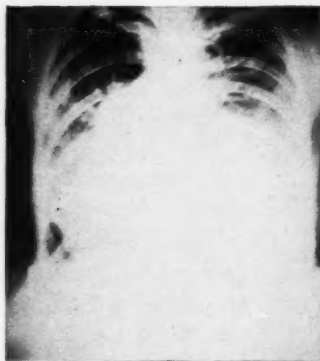


Fig. 3a. Miliary tuberculosis occasionally follows the rapid absorption of a pleural effusion.

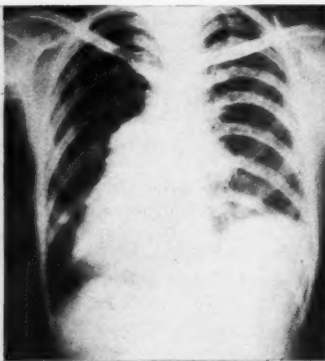


Fig. 3b. (Same case as Fig. 3a.) After absorption of the fluid.

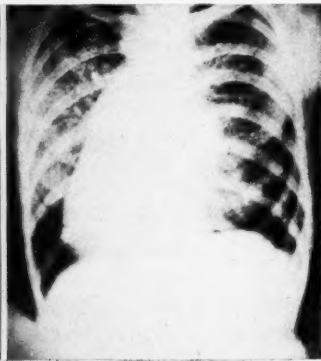


Fig. 3c. (Same case as Figs. 3a and 3b.) Two months later, with development of typical miliary tuberculosis. (Autopsy.)

an asymmetry of the thorax, the left side being slightly longer than the right. There was still slight impairment of resonance from thickening of the pleura which remained. A few râles were detected, but nothing which would indicate the presence of any grave condition in the chest.

Radiographic examination revealed an extensive miliary tuberculosis of the lungs, uniformly distributed in both lung fields. The temperature ranged from 99 to 100 degrees in the morning to as high as 103 degrees in the afternoon. The patient was very sick, being delirious at times. The respiration and pulse were rapid. She died three weeks later (February 8, 1922). Autopsy revealed generalized miliary tuberculosis.

The course of the disease is usually very rapid, the average duration being about four weeks; though rare cases have been reported extending over a period of several months. In one of our patients the disease was known to have existed at least five months, with such mild symptoms that without the radiographic findings its true nature would not have been suspected.

D. L., white, female, age 18, entered the hospital January 8, 1923, complaining of cough, fever, and pain in the chest. Noth-

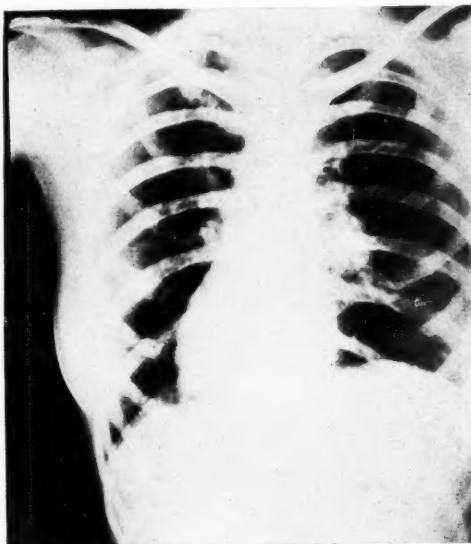


Fig. 4. Miliary tuberculosis of the intestinal type. No evidence of involvement in the lungs. This plate was taken twenty-four hours before death. Autopsy revealed all evidence of the disease in the abdomen, nothing in the chest.

ing in the past history was of importance. The present illness started about three months prior to admission into the hospital (about October, 1922), with dizziness, loss of appetite, and general feeling of fatigue.

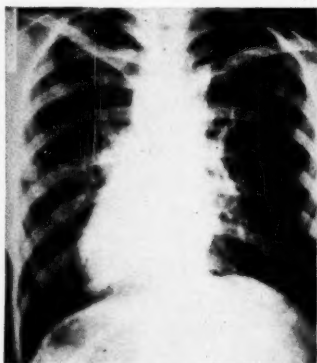


Fig. 5a. A chronic form of miliary tuberculosis has been described. This patient first became sick in October, 1922. Early in November this radiograph was made. At this stage no definite miliary tubercles could be seen.

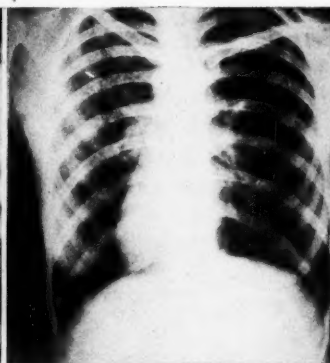


Fig. 5b. (Same case as Fig. 5a.) In the first part of December, however, miliary tubercles developed and the true nature of the disease was revealed. The condition continued quite the same with the exception of an increase in the size of the infiltrations for almost six months, when death occurred.

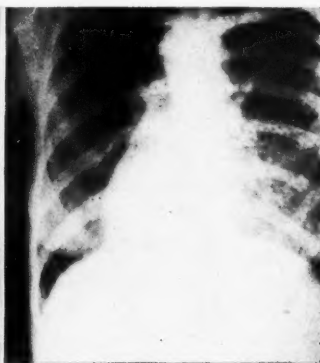


Fig. 5c. (Same case as Figs. 5a and 5b.) Condition just before death. At no time did the patient appear seriously sick. The temperature was rarely above normal.

There was a loss of about nine pounds in weight during this period.

Physical examination at this time revealed a few râles and some indication of pulmonary involvement, but nothing which

Following her discharge from the hospital she was visited at her home on several occasions and radiographs made of her chest with portable apparatus. These showed little, if any, change, except that

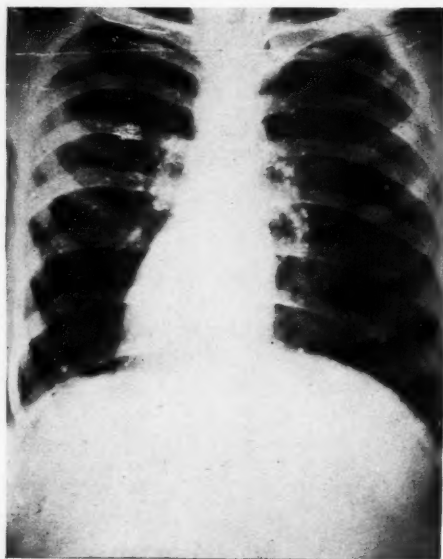


Fig. 6. Probable case of healed miliary tuberculosis showing numerous minute shot-like calcium deposits throughout the lungs. This patient was observed for over a year and showed no change in the lesion.

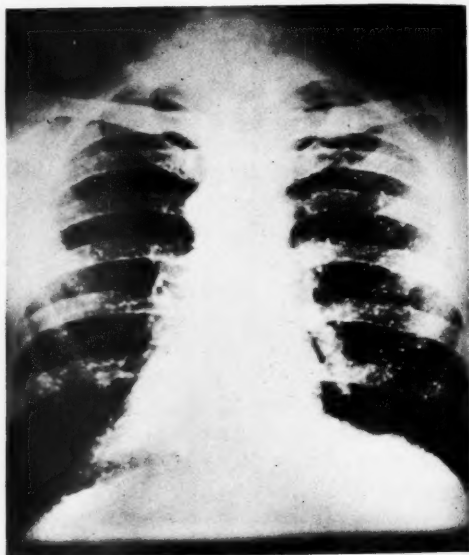


Fig. 7. Healed miliary tuberculosis discovered in an individual suffering from lymphosarcoma of the neck,—which might easily be mistaken for a miliary type of malignant metastasis.

would indicate the presence of a miliary tuberculosis. During her stay in the hospital her temperature was for the most part normal,—on one or two occasions only, did it go as high as 100.4 degrees.

X-ray examination revealed numerous small, soft infiltrations, uniformly distributed throughout both lungs, the typical picture of miliary tuberculosis. Examination of a radiograph taken previously, in the latter part of December, revealed the same picture, but with the miliary tubercles smaller, and fewer in number.

The patient remained in the hospital for about six weeks, during which time she showed little change. She was kept confined to her bed only with great difficulty, since she did not feel very sick and could not be impressed with the seriousness of her condition.

there was a tendency to coalescence of the lesions. Immediately following her discharge from the hospital she began to complain of a stiffness of the neck. It was thought, of course, that this was evidence of a meningeal involvement. This soon subsided, however. Next her joints began to swell; being only slightly painful, this did not incapacitate her and she was up and about most of the time. This symptom likewise subsided, however. The last plate made of her chest was in the latter part of March. After an illness of three or four days, she finally died in the first week of April. No autopsy was permitted.

Every radiologist has encountered instances in which numerous, minute, shot-like, calcareous deposits are seen in the lungs. Their symmetrical and generalized distribution leads one to think that they may be due to healed lesions of miliary

tuberculosis. A considerable number of such cases have been encountered and an effort has been made to ascertain their cause. The age of the patient does not seem to be a determining factor, since we have encountered the condition twice in children twelve years old. That the condition does not represent any active disease was evidenced by serial radiographs taken of a patient showing this condition, in which no change was noted in the calcareous deposits during a period of nearly a year.

While this condition has been considered as healed tuberculous lesions of a disseminated pulmonary type (2) there is no adequate reason why it might not represent a healed lesion of the generalized miliary type of tuberculosis. Blaine (3) has reported several cases of this type and feels convinced that they represent healed miliary tuberculosis. A most complete and enlightening discussion of the subject is given by Opie (4), who concludes that, while absolute proof of the nature of such lesions is impossible during life, in all probability they represent healed miliary

tuberculosis. He believes that miliary tuberculosis, contrary to the generally accepted opinion, occasionally takes on a chronic form and may heal with or without calcium deposit.

We had hoped that the chronic case cited above, owing to the mildness of the symptoms, might prove to be of this type, and that we would be able to obtain a complete series of examinations showing the course of the disease from the stage of first appearance of the tubercles to the stage of calcification. Only by such an observation will the true character of this condition be definitely established. Until this time, we have sufficient authority in the opinion of able pathologists and roentgenologists for a provisional diagnosis of healed miliary tuberculosis.

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Technic of bladder cystograms.—In making cystograms the bladder should be filled with one of the usual pyelographic mediums. Sodium bromide 16 per cent, or potassium iodide 12 per cent, may be used; they are both inexpensive and easily prepared. The potassium iodide seems preferable, as at 12 per cent it is isotonic and casts a good shadow. These salt solutions, however, have a slightly irritating effect, and if patients have considerable cystitis, silver iodide emulsion 5 per cent is more satisfactory because of its mechanical qualities. It also casts a denser shadow and is very soothing to the inflamed mucosa. After the bladder is filled the urethra should be compressed with a penis clamp or tight bandage, and the first plate taken directly above the symphysis, so that the outline of the bladder will be thrown clear of the sacrum. Two other plates should then be

taken with the roentgen tube tilted so that the first plate is projected to the right, the second to the left. By such means diverticula that are near the base of the bladder and might be obscured by the shadow of the bladder in plates taken directly from above, are thrown so that their shadows fall along the periphery of the bladder and thus are brought into view. The fourth plate is taken like the first, the bladder having been emptied either by voiding, or by a catheter. This plate will disclose diverticula that do not drain, and, also, if the bladder first has been emptied by voiding, will reveal the amount of residual urine that is present.

L. R. SANTE, M.D.

Cystograms: Their Clinical Application and Possible Misinterpretation. Hermon C. Bumpus. Surg., Gyn. and Obst., April, 1924, p. 546.

INDICATIONS FOR USE OF THERAPEUTIC PNEUMOTHORAX IN LUNG ABSCESS¹

By HERBERT M. RICH, M.D., DETROIT, MICH.

IT is important in beginning this discussion to define the term "lung abscess."

As used here, it means a collection of intrapulmonary pus. It may be circumscribed or diffuse; acute or chronic; purulent or gangrenous.

The etiology is equally varied. It may be (a) metastatic (pyemic). This occurs in malignant endocarditis, puerperal septicemia, suppurative periostitis, osteomyelitis, pelvic infections, otitis media with thrombosis of lateral sinus. Embolism and thrombosis of small branches of the pulmonary artery follow, with irregular areas of hemorrhagic infarcts. These soften and break down into irregular suppurating cavities. The abscess by this time is surrounded by a zone of reactive tissue, with intense congestion and edema. Such formations are frequently multiple and vary greatly in size.

(b) Foreign body of organic substance produces a so-called "septic pneumonia." This occurs in:

1. Vagus paralysis.
2. Operations on nose and throat.
3. Aneurysm or tumors in certain localities.

The small areas of bronchopneumonia thus produced show minute points of pus. These rapidly extend and become confluent, ultimately producing one or more abscess cavities.

Abscesses also follow (c) lobar pneumonia, (d) trauma of lungs, and (e) diabetes.

There should also be mentioned those cases of interlobar empyema which burrow a connection to a bronchus and discharge into the trachea. Clinically these cases simulate abscess although the X-ray picture may be very different. A few cases are recorded of abscess following a simple cold.

Tuberculous cavities are purposely excluded from this discussion and in the cases later mentioned no cases of tuberculosis are included.

A lung abscess fully developed is a circular cavity in the lung, filled with a greenish yellow, mostly odorless, pus. The walls of the cavity are infiltrated with pus. The outcome of such a lesion may be (1) spontaneous healing with opening into a bronchus; (2) opening into pleura,—empyema—pyopneumothorax; (3) bronchiectasis; (4) chronic abscess; (5) hemorrhage into the cavity.

The methods of treatment are (1) *spontaneous healing*. This occurs only in the first few weeks of the disease and is usually confined to abscesses in the upper lobe, opening near the hilus into a medium sized or fairly large bronchus. With abscesses in the lower lobe or with a long tortuous sinus, the drainage is always incomplete and recovery is rare.

(2) *Bronchoscopic drainage*.—This is especially useful in the foreign body treatment and its practice is, of course, limited to those who have become expert in the use of the bronchoscope.

(3) *Postural drainage*.—It has been estimated that about 3 per cent of the cases of lung abscess may be successfully drained by periodic inversion of patient. The number of cases in which this is successful is so small that it should not be continued more than two or three weeks, unless there is good evidence that the abscess may be completely emptied by this method. We frequently see cases in which this method has been continued for many months, the patient never completely emptying the abscess and passing by the time when successful treatment could be accomplished without surgical intervention. These patients always become chronic invalids.

¹ Read by invitation before the Radiological Society of North America, Chicago, June 7, 1924.

(4) *Surgical drainage*.—This should be used promptly in those cases which are located near the periphery of the lung. It is, of course, also a last resort in any case which has not been successfully treated otherwise. The technic in such surgery has been greatly improved in the last few years, and mortality from such operations is much less than previous records show. Chronic abscesses call for surgery.

(5) *Therapeutic pneumothorax*.—This method of treatment depends upon the sound surgical principles of drainage and rest. By replacing the negative pressure in the pleural cavity, with a slight positive pressure, the lung is compressed towards the hilus and the abscess cavity emptied into the trachea. This process stops the greater part of the movement of this lung in respiration, and hence affords rest. The compression must be continued until the process of healing has occurred in the lesion.

This method should be the method of choice in all cases of acute lung abscess where there is no promise of spontaneous healing, and where complete emptying of the cavity cannot be obtained by posture. The one exception to this is the peripheral position of the abscess. The latter cases are easily drained to the exterior by the surgeon, and should make prompt recovery. On the contrary, the cases near the hilus, which are most difficult for the surgeon, are those which give the best results with pneumothorax treatment. This treatment is painless and without danger in properly selected cases.

TIME FOR OPERATION

In order to be successful, this treatment must be used before dense adhesions have formed in the pleura. The most advantageous time is between the second and fourth weeks of the disease. If the abscess is not near the periphery, there should be no adhesions formed by this time which could interfere with the success of the proceeding. Cases are on record of the successful treatment of abscess by this method

after periods of one year and more. Chronic abscesses are occasionally benefited. It is unfair, however, to the patient to run the risk of the formation of adhesions by delaying pneumothorax treatment too long. In view of its uniform success under the conditions mentioned, it is doubtful if any such case should ever be allowed to go past the fourth week without the attempt being made to use this method.

PROGNOSIS

Under the older methods of treatment, the outlook for a case of pulmonary abscess was discouraging. Aside from the 3 to 5 per cent that recovered spontaneously, or from the use of posture, there were very few complete cures. The death rate in various series is given at from 64 per cent to 87 per cent. Later figures on smaller numbers of cases treated surgically are more favorable. If the abscess is allowed to become chronic, the surgical treatment is highly difficult and dangerous, and Dr. George Lord is responsible for the statement that "incomplete cure is the rule." On the other hand, the compilation of cases of acute abscess treated at a proper time by pneumothorax, showed 80 per cent complete and perfect recoveries. These figures *should not be compared* with the ones given above, for the reason that the first figures included all types of cases, while the latter figures are for acute cases treated by this one method early in the disease.

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PATHOGNOMONIC RADIOGRAPHIC FINDING IN EARLY PULMONARY TUBERCULOSIS¹

DIGEST OF PRELIMINARY REPORT

By ROBERT H. HAYES, M.D., and I. S. TROSTLER, M.D., CHICAGO

IN brief, the work consists of a combination of serological tests in conjunction with X-ray films. The type of case in which this is necessary is the young adult who shows slight or moderate toxic symptoms, but who does not show any definite or local physical findings.

In these individuals I have been applying a Von Pirquet test to determine whether there are active tubercular anti-bodies present, also using this as a control for the dosage of "O.T." (Old Tuberculin) to be given subcutaneously to produce, if possible, focal reaction.

Before giving the diagnostic dose of tuberculin (3/10 to 5 mg. Old Tuberculin is given), we make a soft film, using a modified Wasson technic; forty-eight to seventy-two hours after that making a second plate, using the identical technic, also making physical examination to determine if focal reaction has occurred.

We found that using the ordinary X-ray technic did not give us definite pulmonary changes,—I mean by this, making too long or too penetrating exposure.

The X-ray technic is as follows:

Exposure: 1/6 to 1/5 of a second, 25 milliamperes, 84 kilovolts peak, 30 inches; anode film distance.

Develop at 65 degrees Fahrenheit (temperature must be absolute) in Eastman X-ray film formula.

We found it a good plan to mark the central beam with adhesive on the back of the individual as he lies on the table, so that both pictures will be identical in position. Center with plumb bob.

DISCUSSION

DR. I. S. TROSTLER (Chicago): In the first place, this presentation by Dr. Hayes and myself is only a preliminary report; we have not had enough cases, nor have we done enough work upon the subject, to justify a complete report. We expect to continue this study and report at a future meeting.

In the second place, it is not to be considered as a procedure to be generally used, but should be used only in conjunction with a tuberculosis specialist or phthisiologist. We insist upon that. The Von Pirquet reaction gives the phthisiologist information as to the amount of tuberculin to be used to produce the focal reaction. A knowledge of the reactions of tuberculin is essential in order to know how much tuberculin the patient can stand.

Thirdly, it is not necessary to use our method of examination in a marked or well-defined case of tuberculosis; only in those cases where no physical signs are present, where the lungs are dry and no râles are present, where you have only a clinical history, lassitude, lowered resistance, etc. Here this test is proving itself invaluable, because it is specific of tuberculosis when it is positive. The shadow on the X-ray film is the result of a focal reaction within the lung, which the lung specialists have long used and recognized. A reaction will not be stirred up if there is no tuberculosis present, nor will the injection of tuberculin stir up a reaction if some other disease is present and tuberculosis absent. *It is a specific tubercular reaction.*

Dr. Hayes says that there is no danger in its use in proper hands. He says that the

¹Presented by Dr. Hayes before the Radiological Society of North America, at Chicago, June, 1924.

patients on whom we have applied the test have been benefited. He has used these injections without showing the reaction upon the film for years, and has not done damage, so we feel safe in its use.

Neither the production of the focal reaction nor the making of radiographic films of the chest is new; but the combination of a film made before the production of the tubercular focal reaction, followed by another film made under exactly the same conditions, after the production of the reaction, and showing the infiltration upon the film, *is new*, and we think it a decidedly worth-while finding.

DR. L. G. COLE (New York): I think this has been a very instructive and a very satisfactory session. There are two things that I have gathered from this meeting. Dr. Rich, when he got up to read his paper, said that he was not a roentgenologist,—he was “not an X-ray man” is what he said. I think that in the past many roentgenologists have worked in hearty co-operation with surgeons, physicians and specialists in various fields, done a large amount of work, and the surgeon or medical man takes the slides and goes off and presents them at a convention without doing credit to the roentgenologist; I do not say without giving him credit, but without doing credit to the science of roentgenology. I believe that when any work has been done in combination between the roentgenologist and a clinician—if the former has done enough work so that his work is fundamental in the presentation of the case, he should be present and describe the X-ray findings. It is exceedingly bad for roentgenology when a medical man who knows little or nothing about roentgenology attempts to demonstrate X-ray findings on plates, no matter how good they are, and when a medical man points out the under surface of the breast and the quadrangle below it as a pneumothorax, I think that it casts discredit on the method of examination,—it casts discredit on those of us who know something about roentgenology. I simply mention that as

one of many erroneous interpretations of the very excellent lantern slides which were demonstrated, and I think we have learned that those of us who are roentgenologists should work in hearty co-operation with the clinician of any specialty, and we should—at considerable expense of time and energy—be present at the meetings and have the privilege of demonstrating that proportion of the paper which is illustrated by roentgenograms.

The only other paper to which I wish to refer is that of Dr. Sante. It was a most excellent presentation. His slides and presentation and the demonstration of his findings and the way he followed the cases makes this one of the most satisfactorily presented papers that I have heard in many days, and I wish to thank Dr. Sante for the presentation of this subject in this very able manner. There is only one point I would like to take exception to, one point perhaps I would like to clarify. Dr. Sante said that the miliary tubercle could not be observed by the X-ray finding; then he promptly went to work to show us acute miliary tuberculosis in its earliest stages. At this time I just want to requote the original quotation which I used from Delafield and Pruden: “Miliary tubercles are small nodules of irregularly spheroidal shape, the smallest hardly visible to the naked eye, the largest as large as a pea. The term ‘miliary tubercle,’ which arose from the crude coincidence in size between small foci of tuberculous inflammation and some forms of millet seed, is now very liberally applied to tubercles which are very much larger, as well as to those which are very much smaller, than millet seeds.” Miliary tubercles which can be seen and felt on the cut section of the lung may develop to such an extent that they can be seen radiographically in three or four days from the onset of the symptoms.

DR. FRANK S. BISSELL (Minneapolis): I want to take just a moment or two to discuss Dr. MacRae’s paper, because, while perhaps there is nothing particularly new

in the paper, there are many things which are of practical value. I can find little with which to disagree. A number of years ago, I made a series of roentgen studies of early tuberculosis, arriving at and reporting some of the same conclusions which Dr. MacRae has so well pointed out, and which time and more experience have failed to disturb in my mind. One of them is that peribronchial tuberculosis as a clinical entity does not exist; or perhaps this statement should be qualified by saying that from a practical standpoint it does not exist, and that from the standpoint of the roentgen diagnostician it should be ignored. In other words, the roentgenologist is on much safer ground if he classifies all cases showing peribronchial infiltration without parenchymal extension, as non-tuberculous. However, there are few rules in medicine which have not their exceptions, and thus the rule itself may lead one into occasional error. To illustrate this, I have in mind the case of a young woman referred to me not long ago to determine the presence or absence of pulmonary tuberculosis. There were no clinical signs, except mild subjective ones, but as she was about to marry a physician, she wished to be reasonably certain that she did not have any tuberculous infection. I made a very careful study of excellent stereoscopic roentgenograms, on two occasions within a week, and could find no signs which I considered in any sense characteristic of tuberculosis. The upper lung fields were entirely free from any suggestion of parenchymal infiltration. In the lower right there was a slightly clouded area, which I described but concluded was due to some non-tuberculous infection. She was declared negative from the clinician's standpoint. She was married, and shortly thereafter suffered a slight hemorrhage. I radiated her lungs again within two months of my first examination, and found very marked and characteristic evidence of parenchymal invasion of the right upper lung field. At the present time she has a small cavity near the hilum, and has shown tubercle bacilli in the sputum,

but is still remarkably free from clinical signs and symptoms.

We shall probably never know whether the slight changes noted at the base, when I made my first examination, were in reality due to tuberculosis, or whether the infection was at that time limited to the mediastinum, the clouded area in the lower lobe being attributable to some other cause. To me, the latter seems the more probable sequence. But if the former is the correct assumption, then it is surely the exception which proves the rule that "peribronchial infiltrations, and broncho-pneumonia-like areas, without parenchymal infiltration, usually mean a non-tuberculous infection."

The point which Dr. MacRae made relative to hilum thickening is equally well taken. It is a dangerous and undependable sign at best, and probably most tuberculous cases which show hilum thickening will also show a certain amount of typical parenchymal infiltration, if their plates are carefully studied.

DR. E. B. KNERR (Kansas City): There are just two topics I want to present. I am glad Dr. Sante again called our attention to and again presented the problem of these minute, shot-like calcifications throughout the lungs which are at times given to our vision on demonstrating a plate of the chest. I have two instances to record, or to note, in that connection, both of them patients suffering with sarcoma, one a girl of fourteen who had an osteosarcoma of the shin. The first plate of the chest of this child showed none of these shot-like bodies. This patient was carried along through a series of treatments extending over about three years,—her life was maintained that long. The sarcoma developed extensive metastases throughout the body toward the end of the child's life. In the third year these minute, shot-like bodies appeared in the lungs, scattered throughout the chest. They gradually increased in number, but the largest of them was not larger than a small pea. Now the question is, Were these metastatic centers of the sarcomatous condition

or not? The child showed no evidence whatever of a tuberculous condition at any time, but the metastases of the sarcoma extended to the scalp, cranium and brain, and finally caused her death.

In the other case, one of von Recklinghausen's disease, there were tumors scattered throughout the body, and a large one extending from the neck to the waist. A plate of the chest of this patient showed the calcified, minute nodules scattered throughout the lungs. These were present in the earliest plates, therefore we cannot say that they were not healed tuberculous centers of the miliary type. But the large tumor of the neck was removed, and sarcoma developed at the incision. Sarcoma, however, was present before operation. In these two instances, the shot-like bodies were associated with the presence of sarcoma.

The second topic I wish to present is this: Our friends who are asking us to make two-meter-distant radiograms of the heart, have led us into a step of improvement in getting radiograms of the chest. At present we make all our chest radiograms at a distance of two meters. Try this long-distance exposure, and you will be surprised to observe how very clearly the minute branches of the bronchial tree, and all other details of the lungs, stand out in your plates. The technic is to simply place your tube about seven feet from the patient and give an exposure of from one to five seconds, at about twenty-five or thirty milliamperes and five-inch gap, using a small radiator tube. The results are really the best we have ever obtained in our chest work.

DR. H. M. RICH (Detroit): The plates which I showed were taken by Drs. Hickey, Evans and Reynolds, of Detroit. I apologize for not having mentioned their names before. I believe I said that I was a clinician and that I would attempt to tell only the clinical story of the plates. In spite of that, I still insist that I know the difference between a female breast and a pneumo-

thorax. If my pointer went to the wrong place, it was simply because I thought it would be presumptuous in me to point out anything to this audience, and I apologize again. I am very much interested in Dr. Sante's remarks about lung abscesses, and if Dr. Graham is still here, I wish he would answer that question about the time. It seems to me that in fairness to the surgeon and everyone who may be attempting active methods, the time of waiting should not be over three or four weeks, which is quite different from three months. I would like to hear what Dr. Graham will say about that.

DR. L. R. SANTE (closing): I have always thought of miliary tubercles as being microscopic in size, and therefore not visible in the radiograph. I accept Dr. Cole's correction, however, and I will endeavor to determine the correct terminology. It is merely, however, a play on words. Whether we see the conglomerate tubercle, the result of several macroscopic miliary tubercles which have coalesced, or the original miliary tubercle which has grown to such a size that you can see it, makes little difference in the radiographic diagnosis. I do not refer to calcareous deposits in the lungs, or anything that is a calcium deposit in association with amyloid degeneration or long-standing suppurations, etc., or deposits in the lungs in association with tumor. We have two dozen of such cases, all of which appear in perfectly good health. The last one I showed has been under observation for a period of a year and was in perfectly good health and had no other disease. I would like to take a moment to discuss the paper on lung abscess by Dr. Rich, which I enjoyed very much. I want to refer to Dr. Graham's mention of the apparent increase in lung abscess, which he thinks is due entirely or largely to our better recognition of the conditions. About two years ago I reported to this Society forty-five cases of lung abscess and classified them in their mode of onset and course, and so on, as to their etiology. If I had

that report to make now, I am sure I could report one hundred forty-five,—in the last five years there has been a marked increase in lung abscess. I do not think I was any better able to recognize lung abscesses two years ago than I was five years ago. A review of these plates shows a greater relative number in recent years. Whereas, two or three years ago, a large percentage of our lung abscesses came from post-tonsillectomies, to-day a large percentage of our lung abscesses come from insidious things like exposure to cold, ideopathic abscesses without apparent cause, following lobar pneumonia, bronchial pneumonia, etc., and the actual number of abscesses from tonsillectomies has not increased, thereby producing a lower percentage from actual observation, which makes me think there is an actual increase in lung abscesses from inflammatory causes. The insidiousness of the lesion is one thing that makes me think this. It may be that an increase in the number of examinations of chest cases by X-ray has augmented this number. For instance, I have a patient who had influenza. A radiographic examination disclosed an abscess with a fluid level, which was substantiated by rupturing and the spitting up of a large amount of pus. The abscess completely disappeared after nine days, and the patient felt all right and was discharged from the hospital. If he had not had a radiograph and had been in a private home somewhere, attended there by a private physician, we would never have known he had an abscess. That may account to some extent for this increase in number. Serial plate examination may also be increasing this number. I would like to ask something with reference to the best time for operation and where operation should be considered. It has been our arbitrary rule that we should give the patient about

three months, but I think that is at variance with the practice of the surgeon—give him about three months to see if he can get well by himself. That three months is not always enough time, I am sure, because we have had three cases, one of seven months, one of nine months and one of eighteen months, where multiple abscesses were present, in which complete spontaneous cure has occurred. I am well aware that it is not a good procedure to wait in such chronic cases, but I am sure that abscesses can get well spontaneously after a period of eighteen months, even where multiple abscesses are present.

DR. MACRAE (closing): There is very little for me to say in closing. The negative X-ray findings and the presence of the positive clinical findings is going to occur from time to time with all of us. Occasionally cases of this sort come up and they serve to humiliate the X-ray man; the clinical man can come on behind him and show positive sputum, evening temperature, easy fatiguability, and those evidences of tuberculosis, in spite of our showing a perfectly clear film, and when that is the case, I simply have to take water. I am glad that Dr. Trostler and Dr. Hayes presented the facts they did. It is a thing to be followed up. Of the films which were exhibited on the screen, the No. 1 in each instance was a darker film than No. 2. They were made with double intensifying screens. When we make X-ray films of the lungs with double intensifying screens, we have very little latitude for comparative study. A very slight fluctuation in voltage will make a very great difference in your penetration, and while I think that the demonstration is exceedingly valuable, it is open to question, but it certainly must be carried out farther.

THE SCATTERING OF X-RAYS¹

By ARTHUR H. COMPTON, Ph.D., Professor of Physics at The University of Chicago

IN selecting the subject of my paper, I have felt that though the members of this Society are interested primarily in what X-rays will do, you will naturally be interested also in what those of us who are working in physics laboratories are finding regarding the nature of these rays. Our experiments on the diffraction of X-rays by crystals, their refraction, etc., have convinced us that X-rays are the same kind of thing as light. We call it electromagnetic radiation. But what is this radiation? Newton thought that light from a candle consisted of a continuous stream of tiny particles, or "corpuscles." For the last hundred years we have been taught rather that light is a wave-motion of some kind propagated through space, and we have thought that experiments have proved this theory. But within the last twenty-five years corpuscles, now under the name of "quanta," have again been called upon, this time to explain experiments which the usual wave theory has been unable to interpret. We have been surprised to find that nearly all of the experiments which have been used to prove that light is a wave motion may be explained equally well on the view that light consists of streams of discrete particles.

One of the most important stages in the contest between waves and corpuscles is now being fought in the X-ray field, over the question of how X-rays are scattered. Will you watch the contest with me for a few minutes?

Just as a piece of paper held in the sunlight becomes a source of scattered light, so a piece of paraffin placed in the path of a beam of X-rays becomes itself a source of scattered X-rays. These rays may be examined by a fluoroscope, a photographic plate or an ionization chamber in the same manner as the primary beam. Just as light coming from zinc sulphide exposed to sunlight consists of a mixture of fluorescent

and scattered light, so, in general, the rays from a radiator placed in a beam of X-rays consist of a mixture of fluorescent and scattered rays. There are the fluorescent K and L radiations, X-rays whose wave length is characteristic of the elements from which they come, and truly scattered rays whose wave length is independent of the material of the radiator but is dependent upon the wave length of the primary beam. From the heavier elements the fluorescent rays usually predominate, but for the lighter elements under ordinary conditions the scattered rays only are present in the secondary beam. It is these truly scattered rays with which we are now concerned.

The classical electron theory has a very straightforward explanation of the scattering of radiation. Have you ever shot off a gun in front of the edge of a wood? If so, you will have heard the echo come back, a true reproduction of the sound of the shot. Each leaf in the forest is set in motion by the sound waves, and because of this motion sends out sound waves of its own in all directions. Obviously it sends out as many waves as it receives, so that the echo is of the same pitch as the original sound.

When an electromagnetic wave traverses matter, exactly the same thing happens. Each electron in the matter is set in motion by the electric waves, just as the leaves were agitated by the sound waves. In virtue of their motion these electrons themselves emit waves at the same rate that they receive waves from the primary beam. It is these reradiated waves which, on the classical theory, constitute the scattered X-rays. Thus the number of waves per second, and hence also the wave length of the scattered rays, is necessarily the same as that of the primary X-rays.

This theory of the scattering of X-rays was first developed in detail by J. J. Thomson. The early experimental work of

¹Read before the Radiological Society of North America, Chicago, June, 1924.

Barkla and others showed so striking an agreement with the theory, that scattering has long been considered as one of the things which can be completely explained on the wave theory.

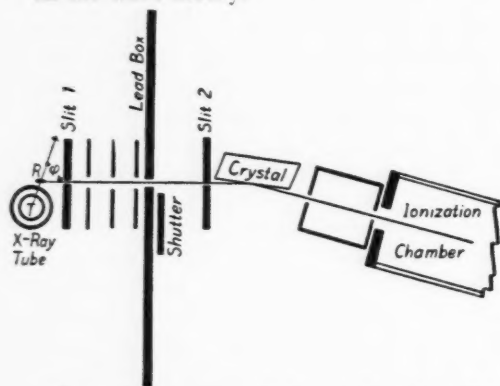


Fig. 1. The spectrum of the rays from the radiator R , at an angle ϕ with primary beam is investigated.

The earliest experiments on secondary X-rays and γ -rays showed, however, a difference in the penetrating power of the primary and the secondary rays. In the case of secondary X-rays from the heavier elements, Barkla and his collaborators showed that it was the presence of soft fluorescent rays which was chiefly responsible for their smaller penetrating power. But it gradually became evident that there was a softening of the secondary X-rays from the lighter elements which was due to a different kind of process.

It was at this stage, about two years ago, that I began the spectroscopic examination of the secondary rays from light elements. These spectra revealed the remarkable fact that the lines in the secondary rays corresponding to those in the primary beam were all displaced slightly toward the longer wave lengths. That is, the scattered rays are of greater wave length than are the rays which produce them.

A diagram of the apparatus employed, such as is shown in the first figure, may help in understanding this result. Here X-rays proceed from the molybdenum target T of the X-ray tube to the carbon radiator R , and are thence scattered at 90 degrees with

the primary beam through the slits 1 and 2 to the crystal of the Bragg X-ray spectrometer. We thus measure the wave length of the X-rays that have been scattered at 90 degrees. This angle may be altered by shifting the radiator and the X-ray tube, and the spectrum of the primary beam may be obtained by merely shifting the X-ray tube without altering the slits or the crystal.

In the next figure are shown complete spectra of both the primary and the scattered beams. Here the broken line represents the spectrum of the direct rays, and the solid line, drawn, of course, on a much larger scale, represents the spectrum of the scattered rays obtained under the same conditions. Though the difference between the first order spectra is not great, in the second order the difference in wave length between the primary and the scattered lines is readily measurable. It is clear from this

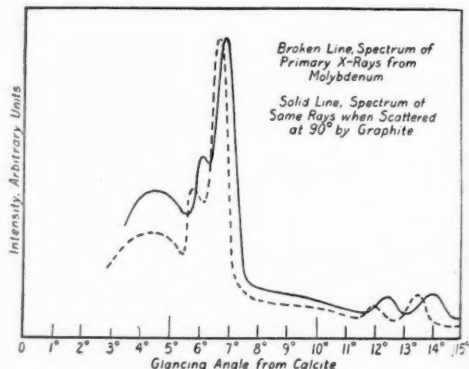


Fig. 2. Spectrum of molybdenum X-rays scattered by graphite compared with the spectrum of the primary X-rays, showing an increase in wave length of the scattered rays.

spectrum that the secondary X-rays do not have precisely the same wave length as the primary rays, but are slightly greater in wave length.

We have seen that on the wave theory of X-rays it is necessary that the scattered rays be of the same wave length as the primary X-rays. Thus if these experiments are reliable, as the noted physicist Sommerfeld remarked when I first showed the results

to him, they sound the death knell of the wave theory of X-rays and hence also of light.

An explanation of these experiments may be given, however, on the basis of the theory of radiation quanta. This is a new

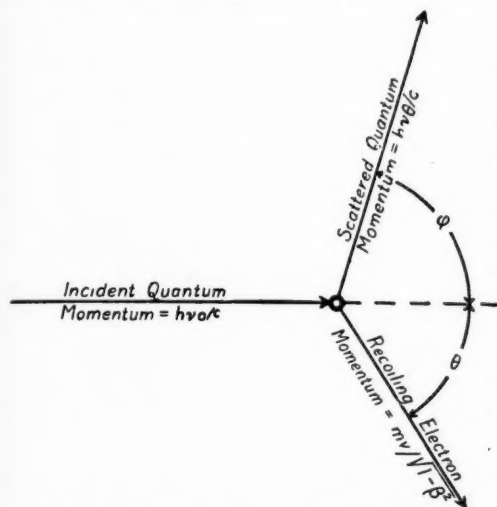


Fig. 3. When an X-ray quantum is scattered by an electron at an angle ϕ , the electron recoils at an angle θ , removing some of the energy from the quantum and hence reducing its frequency.

model of Newton's old corpuscular theory of light, rebuilt by Einstein to suit our modern tastes. On this theory, X-rays or light rays consist of streams of minute particles, shot with tremendous speed from the target of the X-ray tube or from the source of light. These particles, or quanta, as they are called, do not have the form of a wave, but are concentrated bundles of energy. Instead of distinguishing a ray by its wave length, we now specify the momentum or the energy carried by each particle. The momentum of the quantum particle is inversely proportional to what we call the wave length. That is, a quantum of hard X-rays has a relatively large momentum, while a soft X-ray quantum has small momentum. An idea of the magnitude of these quantities may be gained if I state that the mass of hard γ -ray quantum is about the same as that of an electron, which is our smallest unit of ordinary

matter. The mass of an ordinary X-ray quantum is about 1/20th as great, and that of a light quantum about 1/200,000th as great as that of an electron or cathode particle. It would take about as many X-ray quanta to weigh as much as a mosquito as there are drops of water in the ocean.

Let us suppose that such an X-ray particle is shot at one of the electrons of which the scattering block is made. We may imagine that it is deflected by the electron in some such manner as shown in Figure 3.

It will be deflected particles of this kind which on the quantum theory constitute the scattered X-rays. The collision will be similar to that of a golf ball striking a perfectly elastic football. Though the collision is elastic, the football will recoil from the golf ball, and the golf ball will therefore bounce off with less momentum than it had when it struck. Similarly the scattered X-ray quantum will have less momentum than the incident quantum, due to the recoil of the electron which it strikes. This decrease in momentum, as we have seen, corresponds to an increase in wave length. The theory when developed mathematically indicates an increase in wave length of $0.024 (1 - \cos \phi)$ Ångström Units, where ϕ is the angle at which the rays are scattered. The wave length change should thus vary from zero, when the rays are scattered forward ($\phi=0$), to about .05 Ångströms for the rays scattered backward ($\phi=180^\circ$). Using rays of 0.15 Ångströms wave length, such as are ordinarily used in deep therapy, this means an increase in wave length of about 33 per cent.

This theoretical formula was derived before any precise measurements of the wave length change had been made. Next came its quantitative test. In the next figure are shown the results of some later experiments, using this time a spectrometer of higher resolving power and studying the rays scattered by graphite at different angles. The only difference between the two sets of values shown in this slide is that the curves on the right were obtained with

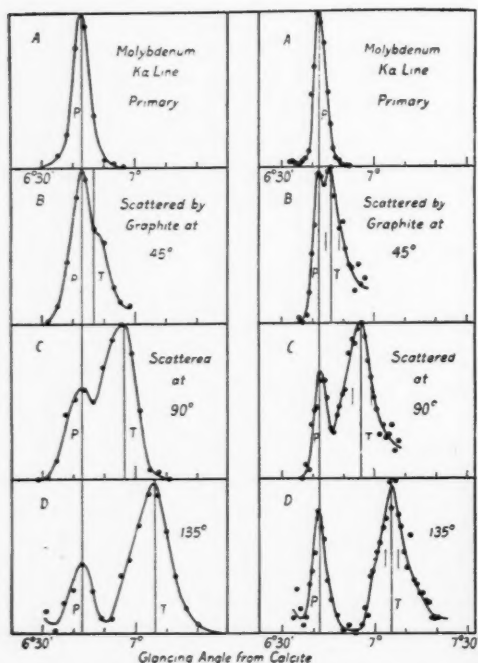


Fig. 4. When an X-ray spectrum line is scattered, it is broken up into two lines, one of unmodified wave length P and a line T whose wave length is increased by the amount $h/mc \times (1 - \cos \phi)$.

the use of narrower slits than those on the left. The upper curve is the spectrum of the $K\alpha$ line of molybdenum, and the curves below are the spectra, using the same slits, of the rays scattered at 45° , 90° and 135° , respectively. The positions of the lines T are calculated from the formula given by the quantum theory. As you can see, in every case these lines fall within experimental error on the peak of the line of increased wave length.

The line in the spectrum of the scattered rays which is unmodified in wave length may be explained as due to quanta which are deflected by electrons held too firmly in the atom to recoil at the collision.

Clark and Duane, at Harvard, have attempted to repeat this work during the past year, and have failed to find evidence of a change of wave length such as I have just described. My results have, however, been confirmed by Ross, at Stanford University, Davis, at Columbia, Becker and

others, in Millikan's laboratory at Pasadena, and by de Broglie and Dauvillier independently at Paris.

As an example of this work, let me show in the next figure some beautiful photographic spectra obtained by P. A. Ross, using prolonged exposures—as long as 250 hours. At top and bottom are the spectra of the primary beam, showing the $K\alpha$ doublet resolved and the $K\beta$ line just off the edge of the photograph. The second photograph shows the spectrum of the rays scattered by paraffin at 55° with the primary beam, and the third photograph that of the rays scattered at 90° . Within an

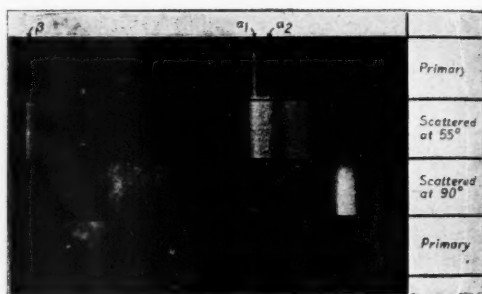


Fig. 5. Spectrum of K-rays from molybdenum, scattered from paraffin and reflected from calcite (P. A. Ross).

experimental error, which is very small indeed, the wave length of the unmodified line shown in these photographs is the same as that of the primary line, and the wave length of the modified line is greater by the amount predicted by the quantum formula.

That this effect is not analogous to fluorescence, which depends upon the material of the radiator, is shown by the spectra in Figure 6, in which a series of different light elements are used as radiators. Here we see that the same change in wave length occurs whatever substance is used as scattering material. Experiments have also been performed which show that the same wave length change occurs for primary rays varying in quality from soft X-rays to hard γ -rays.

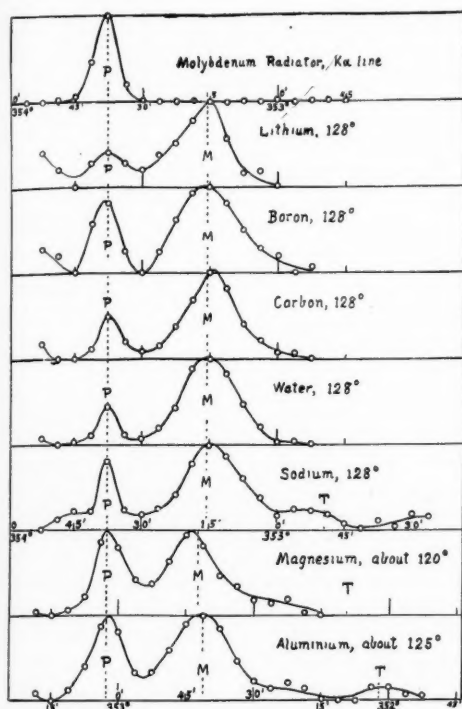


Fig. 6. Spectra from calcite of the secondary radiation from various elements, traversed by X-rays from a molybdenum target. *P* marks the position of the primary $K\alpha$ peak, and *M* the theoretical position of the modified peak.

In our explanation of this effect on the quantum theory, we supposed that each electron recoils when it scatters a quantum of X-rays. From the quantitative agreement between the theoretical and the observed wave lengths of the scattered rays, we may look with some confidence for these recoil electrons. When this theory was proposed there was no direct evidence for the existence of such electrons. During the past summer, however, two experimenters, C. T. R. Wilson, at Cambridge, and Bothe, at Charlottenburg, have independently discovered by the method of Wilson's cloud expansion photographs the existence of a new type of secondary β -rays which they have identified as these recoil electrons.

Let me show you some of Wilson's photographs in which these new rays appear.

Figure 7 is a photograph obtained with the use of X-rays that are not very hard. You will see four long tracks, originating in the path of the primary beam, which are produced by electrons that have absorbed the whole energy of a quantum of the incident X-rays. These are the photoelectrons, whose existence has long been known. But there are also within the primary beam several very short tracks which appear as spheres. It is tracks of this character which Wilson has identified with the electrons which recoil from scattered quanta. When harder X-rays are used, as in the next figure, these short tracks increase in length, and develop "tails" on the side of the incident X-rays. For this reason Wilson has dubbed them "fish" tracks. It is a significant characteristic of these fish tracks that their heads are all pointed in the direction of the incident X-ray beam, as is to be expected if they are due to recoil electrons. Let me show one more of Wilson's photographs, revealing both the long and the short tracks, which illustrates the fact that the fish tracks which start directly forward are longer than those which move at an angle with the primary ray. You see here photographs of the actual tracks of electrons which have been knocked out of their resting places by the impact of individual X-ray quanta. If a golf ball bounces straight back from a football, the football receives a strong impulse straight ahead, as in the case of the electron *a*. If the golf ball glances from the football, the football receives a much smaller impulse at some angle with the golf ball's motion. This is what happened to electrons *b* and *c*.

The direction, range and number of these fish tracks have been shown to be in good agreement with the view that they are due to electrons which have recoiled from the scattered quanta. In view of the fact that these recoil electrons were unknown at the time this theory was presented, their existence, and the close agreement with the predictions as to their number, direction and velocity supplies strong evidence in

favor of the quantum theory of X-ray scattering.

A number of applications of this new theory of X-rays have been made. Thus, for example, it has been possible on the



Fig. 7.



Fig. 8.

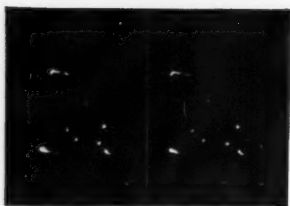


Fig. 9.

Cloud expansion photographs (Wilson) showing long β -ray tracks produced by photo-electrons and shorter tracks which are identified with the electrons recoiling from scattered X-rays.

basis of this theory to calculate with accuracy the absorption and scattering of hard γ -rays, a calculation which was impossible on the usual wave theory. This calculation revealed the fact that for these very hard rays a considerable fraction of the energy of the γ -rays is spent in setting the recoiling electrons in motion, a type of absorption of energy which is unimportant for rays of greater wave length. It thus became apparent that to secure the greatest penetration in such light materials as water or the human body, especially when beams of large cross-section are employed, rays

of considerably greater wave length than γ -rays should be used. Under the conditions which usually prevail in X-ray treatment, the most penetrating wave length is probably about 0.1 Ångström.

The most important result of this work, however, is the information which it gives regarding the nature of electromagnetic radiation. We find that the wave length and the intensity of the scattered rays are what they should be if a quantum of radiation bounced from an electron, just as one billiard ball bounces from another. Not only this, but we actually observe the recoiling billiard ball, or electron, from which the quantum has bounced, and we find it moves with just the speed it should if a quantum had bumped into it. The obvious conclusion is that X-rays, and so also light rays, consist of discrete particles proceeding in definite directions.

It is naturally not without a protest that the advocates of the wave theory receive this conclusion. Among the defenders of this theory are C. G. Darwin, brilliant grandson of the great Charles, and Niels Bohr, recent recipient of the Nobel Prize in Physics. These men have shown that the phenomena of X-ray scattering, which I have described, can be reconciled with the wave theory if we will forget two little principles. These are Newton's principle that action and reaction are equal and opposite, and the principle of the conservation of energy.

It is these very principles, however, which underlie the quantum theory which explains the change of wave length of scattered X-rays and which predicts the recoil electrons. The success of the theory is accordingly a confirmation of the applicability of these fundamental principles to the problem before us. Thus, I think that most of the physicists who have considered seriously the significance of these experiments feel that they mark the decline of the wave theory of light and X-rays and the rise of the corpuscular or quantum theory. Among those who have expressed this view-

point may be mentioned Einstein and Sommerfeld in Germany, de Broglie in France and Rutherford in England. If this theory finally prevails, we shall have to abandon

the idea of waves and think instead of the X-rays as streams of little bullets or arrows shot with tremendous speed from the targets of our tubes.

Response of tumors to radiation.—A highly important incidental phase of the development of radiation therapy of cancer has been the increased attention paid to the biological and physiological peculiarities of different tumors. Some of the observations resulting from the experience with the behavior of tumors under radiation are very interesting.

The response of a tumor to radiation, in general, depends on the character of the blood supply and the qualities of the tumor cells. Delicate blood vessels and rapidly growing cells render the tumor highly susceptible to radiation.

In tumors of lymphoid character the vulnerability depends chiefly on the character of the cells, but the blood vessels also are quite susceptible, because when these growths become fibrous and the vessels thicker, they are more resistant.

Hodgkin's granuloma tends to become fibrous and this tendency soon halts the beneficial effect of radiation.

All embryonal tumors are highly radio-sensitive, which explains the favorable response of basal-cell carcinomas, many common tumors in children, embryonal carcinomas of testis and ovary, and perhaps many uterine cervical carcinomas. Very different is the response of the anaplastic carcinomas derived from adult cells, which form the majority of rapidly growing, diffuse carcinomas of the glandular organs.

The majority of malignant tumors are not radio-sensitive and do not respond to a dose which is below the cauterizing dose. Squamous-cell carcinoma of the skin and mucous membrane is the chief example of an adult tumor arising from adult cells by chronic irritation and reproducing adult cells, and also producing much re-

sistant connective tissue. In these tumors only the caustic effect of radium will be successful. This difference between the response of embryonal and adult classes of tumors was soon revealed as a formidable obstacle to radiation therapy.

In a third group, the tumor is either so bulky or so inaccessible, or so resistant, that neither selective radiation nor caustic effect can be successfully employed, and radiation must be content, for the present at least, with growth-restraint. In this group are included mammary and other glandular carcinomas, many deep-seated tumors, osteogenic sarcomas and neurosarcomas. This matter of growth-restraint is a new but important viewpoint and one which demands close attention in modern cancer therapy. In a considerable series of neoplasms, growth-restraint transforms the tumor into a comparatively innocuous process, e.g., in Hodgkin's, in leukemia, in generalized lymphosarcoma.

The attack on osteogenic sarcoma has resulted in differentiating the group of round-cell tumors from the fibroblastic tumors, the former being susceptible and the latter very resistant. The cellular forms of osteogenic sarcomas may be converted into solid, bony tumors which will remain quiescent for a long time. The medullary giant-cell bone tumors also respond to radiation more readily than the osteogenic forms.

Whatever may be the final verdict on radiation as a curative agent for cancer, there has already been a great permanent contribution to the study of the cancer problem.

W. W. WATKINS, M.D.

The Influence of Radiation Therapy on the Study of Cancer. James Ewing. *Canadian Practitioner*, March, 1924, p. 95.

THE SACRO-ILIAC JOINT: ITS DIAGNOSIS AS DETERMINED BY THE X-RAY¹

By BYRON C. DARLING, A.M., M.D., NEW YORK

THIS paper will limit itself more to the consideration of what is variously called sacro-iliac dislocation, subluxation, relaxation, separation or sprain, resulting from injury either traumatic or due solely to lifting. In workmen more



Fig. 1. Side view of sacrum, showing broad, rough and rugged articulating surface, which with its many anterior and posterior ligaments binding a keystone into a girdle should be mechanically a most secure articulation.

frequently than in others X-ray examinations are requested to ascertain the existence of a demonstrable fracture or dislocation or any other condition which would account for backache or pain over the lower lumbar vertebrae and sacrum. No attempt will be made to go into the clinical symptoms other than to give the list of symptoms as summarized by Albee (1) in

his book under *Diagnosis*: "(1) Pain in the region of the affected joint on turning over while in the recumbent posture. (2) Discomfort while lying on the back. (3) Pain produced by sitting on a hard chair and relieved by sitting on the opposite buttock. (4) Pain in the affected sacro-iliac joint on forward bending. (5) Pain on deep pressure over the affected sacro-iliac joint. (6) Listing of the whole spine on the side opposite the lesion. (7) Goldthwait's symptom (pain referred to sacro-iliac region or to the leg of the affected side when the thigh is flexed with the leg extended)."

It will be well to approach the subject by considering the anatomy of the joint. The sacrum is a wedge or keystone completing the pelvic girdle posteriorly, bound in place by heavy ligaments anteriorly and posteriorly well interlaced (Fig. 1). Its sacro-iliac articulation is made up of a large auricular articulating surface covered with cartilage on either side and variously reported by anatomists as having a joint space or none. An attempt to settle this question was made by Albee and reported in his article (2) read before the Section on Obstetrics and Diseases of Women at the American Medical Association meeting in June, 1909. He concluded that the sacro-iliac articulation has all the elements of a joint and therefore has a similar pathology; that it contains a joint cavity with synovial membrane with a well-formed capsule which is constant in size and relations, as any other joint. In his fifty dissections the interosseous ligament always separated from the ilium and never from the sacrum. The round ligament sometimes ruptured and sometimes its bony attachment. One joint out of fifty was affected with osteo-arthritis and the anterior part of the joint was obliterated with a bony deposit.

¹Read before the Radiological Society of North America at Chicago, June, 1924.

Albee makes a comment in his article in which he seems to contradict himself, namely: "Under favorable circumstances, however, this joint will stand much abuse, as in the case of a symphysiotomy." In the light

demonstrate clinical cases of sacro-iliac relaxation, has been a matter of great interest, and I have been constantly hoping to make this diagnosis from stereoscopic X-ray examinations in order to confirm the



Fig. 2. Rotation of pelvis to right presents a wide left sacro-iliac cartilage. Note asymmetry of: (1) wings of ilia wide on right, foreshortened on left; (2) true pelvis; (3) obturator foramina; (4) necks of femora.



Fig. 3. (Same subject as Figure 2.) No symptoms. Rotation to left reverses the asymmetry at will. Subject was blocked up on either side by wood $\frac{7}{8}$ inch thick. The crosswise shift of stereoscopic tube will distort likewise.

of ordinary sprains and separations, as I understand them, a symphysiotomy with a definite spreading of the pelvic girdle and a mechanical separation at the sacro-iliac articulation would be much the greater injury.

The question of destructive disease will not be discussed. Hypertrophic arthritis as shown by Albee's one definite case in fifty tends toward the obliteration of the anterior part of the joint. This bony ankylosis all roentgenologists no doubt have seen and recognized as such. The findings of lipping and spurs at the lower margin of the joint will depend on the age of the patient, and, if the cartilage space is intact, may or may not mean the presence of some chronic inflammatory condition of the joint. Many of these spurs can in no positive sense be taken as an indication of symptoms or disease.

The diagnosis by the X-ray examination ever since my medical school days, when I had the opportunity of seeing Goldthwait

clinical diagnosis. Only within the last few years have I felt myself ready to take a definite negative position. I will show by lantern slides (see Figs. 6, 7, 8) in cases of separations at the symphysis and fractures of the pelvic girdle the sacro-iliac separation is sufficiently definite so that roentgenograms made from any angle show the separation in question in any single plate without the aid of the stereoscopic effect.

Goldthwait also considers this a true joint and claims the motion consists of a forward and backward tilting of the sacrum in relation to the ilium. This relaxation, if present, would be so small as to make it impossible to demonstrate by the X-ray stereoscopic examination. Especially in the case of a movable relaxation, it might adjust itself anatomically with the patient on his back on the X-ray table with or without the knees flexed. The displacement up or down is not claimed and not seen.

Dr. L. B. Morrison, of Boston, who does work for Goldthwait, directs the central ray

through the upper part of the sacrum parallel with the curve of the carus, which is a reasonable position for showing forward or backward tilting. He believes he sees this in certain cases.



Fig. 4. Stereoscopic No. 1. Same pelvis as shown in Figures 2 and 3, posed correctly in relation to central ray. Pelvis is now symmetrical except for a common degree of rotary lateral curvature.

Whether Morrison's technic is conclusive or not, let us consider now the routine technic and posture for making a stereoscopic X-ray examination of the pelvis and sacro-iliac joints. The stereoscopic shift must be with the spine and not across it. The pelvis and lower spine should be correctly, that is symmetrically, posed in relation to the central ray. (See Figs. 4 and 5.) This is not always possible on account of anatomical variations, such as the different degrees of rotary lateral curvature of the spine.

In the roentgenogram the ribbon or line of the cartilage space anteriorly over the joint is carefully examined and this is followed down to its lower margin which runs backward toward its posterior articular surface. Usually the separation is said to be demonstrated by the increase in width of this ribbon on one side over the other, but often a careful inspection of the roentgenogram will show that the pelvis has been rotated toward the opposite side. (See Figs. 2 and 3.) This is disclosed by an increased breadth of the wing of the ilium on the

opposite side, with a definite foreshortening on the near side. The spine of the ischium is much more prominent on the opposite side where the clear space between the shadow of the brim of the pelvis and the



Fig. 5. Stereoscopic No. 2. (Same case as Figures 2, 3 and 4.) Tube shift up the spine. Still symmetrical. Proper technic for pelvis and hip joints and all spine stereoscopic work.

margin of the lower part of the sacrum is asymmetrically increased. The obturator foramen here is now larger as compared with the opposite. The center of the symphysis pubis in front is displaced to the opposite side of the line made by the fold of the buttocks. The density of the region on the side in question is lessened, while on the opposite side there is a definite increase, due possibly to the rotation with the interposition of a greater amount of muscle of the buttocks.

This latter is interpreted by those who are determined to demonstrate a sacro-iliac dislocation as showing atrophy of bone and muscle, but I will show by my lantern slides (Figs. 2 and 3) that this is produced at will and is clearly a matter of posture in the subject examined and, therefore, too uncertain a foundation for establishing or confirming the diagnosis.

There is a great need for the standardization of the diagnosis of this condition. (See Figs. 4 and 5.) It is now being too frequently used as a foundation for law-

suits. One roentgenologist will affirm under oath that there is a definite dislocation or relaxation or separation, while another or several others may strongly affirm to the contrary. The younger X-ray men may feel that they should be able to make this

onstratation, which I will show by lantern slides (Figs. 2, 3, 4, 5), and have been able to convince the judge and the jury.

A brief summary of the opinions of different authorities adds weight to my contention.



Fig. 6. Patient caught between an auto and telegraph pole. Pelvic girdle is broken and allows separation at lower margin of right sacro-iliac joint. Left is still intact, although left wing of ilium is badly fractured.



Fig. 7. Pelvic girdle separated at symphysis (uncommon), with small cortical fracture above body of right pubis. Right sacro-iliac separation below is shown clearly.

diagnosis from the X-ray examination. The referring physician expects it or the lawyer wishes it, and even a conscientious man may be misled by some of the fallacies to which I have previously called attention. For a while one clinic discovered nineteen of these cases in a month in workmen. This, of course, would be claimed as a permanent disability and would carry with it a compensation of anywhere from one to three thousand dollars. If twenty X-ray men throughout the country found twenty of these a month, the figures would total from five to fifteen million dollars per year, and the premiums on liability insurance would have to be materially advanced. Also, many workmen who would otherwise shortly recover from a lame back would feel disabled for life, and, having established a traumatic neurosis on this basis, would naturally be of very little further use to themselves, their families, or to industry. In regard to the use of this diagnosis as a foundation for the claim of heavy damages in lawsuits, I have used the dem-

Whitman (3) says: "X-ray pictures are of practically little value in diagnosis and an actual laxity of the articulation can rarely be demonstrated except in cases incidental to pregnancy."

Albee (4) says: "X-ray examination reveals an increase of the sacro-iliac space."

Baetjer (5) says: "The so-called sacro-iliac subluxations, in the writer's opinion, do not exist. The joint is of the saw-tooth variety and before a slipping could take place these saw-tooth edges would have to be broken. These conditions must be ligamentous sprains." And again: "It is perfectly true that one frequently sees one side of the sacrum higher than the other, suggesting slipping, accompanied at the same time by marked clinical symptoms. Manipulation under anesthesia and fixation by a plaster cast will result in complete recovery, yet a second X-ray examination will fail to show any change at all in the position of the sacrum. The sacro-iliac articulation is one of the strongest in the body,

and its anatomical structure is such that only the most severe trauma could cause it to slip."

Holmes and Ruggles (6) say: "The sacro-iliac joint may be disarticulated as a



Fig. 8. No sacro-iliac separation shown. Fracture through obturator foramen on right above and below, with only slight displacement.

result of severe trauma. The so-called sacro-iliac slip is not demonstrated on plates."

George and Leonard (7) say: "Without exception, in our opinion, there has been more harm accomplished, especially in this industrial work, by the use of the term and diagnosis 'sacro-iliac dislocation' than through the use of any other term or diagnosis contained in the medical literature. The diagnosis is based entirely upon clinical evidence and with the least positive X-ray evidence so far as the sacro-iliac synchondrosis is concerned."

H. W. Marshall (8) says: "Positions of bones seen in single X-rays furnish no absolutely conclusive evidence usually in simple sacro-iliac strains without fractures. Single X-rays do not show whether changes of ligamentous laxity have been slight or great. In industrial accidents it would be necessary, if X-rays alone were depended on, to have them taken before any changes that might occur. X-ray variations in hor-

derline cases are so slight that it is impossible to tell from them alone whether they represent old compensated slight laxities of no significance or recent changes of positions of bones that are intimately connected with existing symptoms."

Too frequent use of sacro-iliac separation as an X-ray interpretation is liable to bring any man under adverse criticism from his more thoughtful and experienced colleagues.

CONCLUSIONS

1. Backache has more to do with the soft tissue, ligaments, muscle fibers, bundles and sheaths, nerves and neuralgias, than dislocations of joints. Sprains, sacro-iliac and lumbo-sacral, seem more likely than demonstrable relaxations or subluxations.

2. The sacro-iliac joint has a synovial lining and is, therefore, subject to arthritis, due to any focus of infection.

3. Sacro-iliac strain, relaxation, subluxation or dislocation may exist clinically, but cannot be shown definitely by the X-ray examination if and when "the motion consists of a forward and backward tilting of the sacrum in relation to the ilium."—*Goldthwait*.

4. Where there is actual separation of the pelvic girdle, such as complete fracture with displacement or a complete separation at the symphysis, then only will there be shown by the X-ray a definite sacro-iliac separation or relaxation.

5. Radiographs of the pelvis are at their best only when the pelvis is level and correctly centered in relation to the central ray. Since a degree of curvature of the spine is common, this may be difficult to attain. The stereoscopic shift should be vertical and not across the pelvis.

6. Radiographs made improperly are often misinterpreted as showing separations which do not exist. This is a too common

error, due to zealous attempts to make or support a diagnosis.

7. The weight of opinion among experienced roentgenologists is in the negative, and is almost unanimous.

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Backache.—One prominent cause of backache is congenital anomalies of the vertebrae. We must not be too willing to ascribe clinical symptoms to the presence of congenital anomaly simply because it exists. We know that defects often exist without cause or clinical signs. Their chief importance is derived from their tendency to weaken the mechanical construction of the part. The lumbosacral region being the most unstable portion of the column it is most subject to developmental defects and anomalies.

The study of some 850 spinal columns in the Hamann Museum has convinced the writer that the congenital anomalies of clinical importance in low back pain may be divided into two general groups: defects of the last presacral vertebra, and anomalies of the articular processes between the last lumbar and the first sacral segments. The first group includes one or more interruptions in the neural arch. This group includes variations in size and form of the transverse processes of the last lumbar segment and its occasional impingement upon or articulation

DISCUSSION

DR. DARLING (closing): I have nothing further to add except that it is going to be a terrible pest in the courts, if we can tell from the way they have got off to a running start in New York City. This sacro-iliac subluxation ran itself out several years ago, and now it has got its second wind and is going strong. I hope that I have demonstrated what I started out to do,—that diagnosis cannot be made by the X-ray examination, and I am doubtful whether eminent orthopedic or other men know what they are talking about either. A pain in the back is a pain in the back, and it is due to a condition in the soft tissue, ligaments or bones or an arthritis of this joint, if it is a true joint, and a dozen and one things, and the less damage a man thinks he has, the less you tell a man he is damaged, the sooner he is going to recover.

with the ilia. The defect may be central, lateral or even bilateral. Central splitting of the canal may occur. Sacralization in the X-ray may be only apparent, the flat plate indicating impingement, whereas in reality the processes may not encroach upon the ilia, but extend down behind. Variations from the usual articular arrangement have recently been described. Such variations consist particularly in the degree of development and angle of projection of the inferior articular processes of the last lumbar and the superior processes of the sacrum. It is the apposition of the latter to the former that normally prevents the lumbar spine from coasting downward and forward over the oblique superior surface of the sacrum. When the bony anchorage is lost the stability of the spine is dependent upon its ligamentous structures. These defects are frequently demonstrated when no symptoms exist.

L. R. SANTE, M.D.

Backache from Vertebral Anomaly. Theodore A. Willis. Surg., Gyn. and Obst., May, 1924, p. 658.

ACROMEGALY FOLLOWING GIGANTISM: REPORT OF CASE TREATED BY X-RAY

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ACROMEGALY was first accurately described, and was named, by Marie in 1886. It is a condition occurring in adult life, characterized by enlargement of the "acra," i. e., the hands, feet, lower jaw, nose and lips. Typically, the skeletal changes consist in enlargement, with tufting, of the terminal phalanges of the fingers and toes, enlargement of the bones, as well as the soft tissues, of the hands and feet, overgrowth of the inferior maxilla with progressive malocclusion of the teeth, and increasing prominence of the frontal region, with great enlargement of the frontal sinuses. It is stated (Bassoe) that the bone changes are secondary to changes in the soft parts, and are, indeed, caused by these soft-tissue changes.

Cushing gives four views as to the causation of acromegaly. The first is Marie's conception of it as a general dystrophy, although he later believed it to be caused by a *diminished* hypophyseal function. The second is that it is due to an eosinophilic hyperplasia of the pituitary, with or without enlargement, producing hyperfunction. This is the view of Benda, Lewis and Erdheim. The third conception is that the changes are due to an underlying nutritional disorder, the hypophyseal enlargement being secondary and not primary. The fourth view is similar to the third, in that it assumes the hypophyseal changes, when present, to be only an accidental finding, without true relationship to the disease. It is apparently accepted by most recent writers on the subject that the disease is invariably characterized by a period of hyperfunction of the pituitary, and that this period is an essential factor in the mechanism of the changes produced, whether it be the primary, or the only, factor, or not.

Gigantism is, as its name implies, a symmetrical sort of giant growth, in which both bones and soft tissues attain more than the

normal size for the age, though the character of growth remains normal, and without deformity. Like acromegaly, gigantism is caused, or at least partially caused, by hyperfunction of the anterior lobe of the pituitary gland. Unlike acromegaly, gigantism is a disease of adolescence, of the period prior to the union of the epiphyses. Apparently the same process occurring in an adolescent, which causes acromegaly in the adult, produces gigantism.

It, then, apparently follows that if the morbid process continues active after epiphyseal ossification occurs, the disease will take on the character of acromegaly, following the gigantism which non-union of the epiphyses permitted to occur first. If the process begins in adult life, the changes will be purely acromegalic; while if the stage of hyperfunction begins and ends prior to epiphyseal union, the condition will be pure gigantism. In any event, the stage of hyperfunction is apparently always followed by a period of hypofunction. This transition marks the end of the bone change, but of course no retrogression occurs, and the changes are permanent records of the active stage. Thus the finding of typical skeletal alterations does not imply that there is, but merely that there has been, pituitary hyperfunction. This fact must be borne well in mind in the diagnosis, and particularly in the treatment of such cases, since it would obviously be most unfortunate to curtail still further the activity of an already hypofunctioning gland.

Changes in the sella turcica, demonstrable by X-ray, may or may not accompany acromegaly or gigantism. Crushing offers the arbitrary rule that the normal sella may attain dimensions of 15 by 10 millimeters, and that any sella larger than this is to be considered enlarged. Observations on a considerable number of normals (Enfield, *Jour. A. M. A.*, vol. LXXIX, p. 934) would

seem to show that the normal sella may vary more widely than this without necessarily implying pathology. It would appear that conclusions ought rarely, if ever, to be drawn from the mere size of the sella, or

is borne in mind, it will be seen that the symptoms usually present an orderly and explicable sequence.

The subject of the case report was a white male, aged 18 when first seen in Oc-



Fig. 1. Postero-anterior head (Waters-Waldron) showing size of frontals, antra, etc.

from its shape, which also varies quite widely in the normal. When enlargement produces changes, either through tumor formation or simple hyperplasia, which are definitely demonstrable by X-ray, these will be in the nature of erosion or destruction, and not of mere enlargement or change in contour. Tumor formation or hyperplasia resulting in gross enlargement of the pituitary may or may not be a part of the picture of acromegaly or gigantism, so that the absence of any demonstrable change in the sella by no means stands in the way of a definite diagnosis of acromegaly or gigantism.

With the other symptoms, the pituitary headache, the constriction of the visual fields, the polyuria, the changes in the blood pressure, the lessened sexual function, changes in sugar tolerance, altered basal metabolic rate, and the increased fatigability, we shall not concern ourselves except as they appear in the case here reported. However, when the conception of a condition of hyperfunction, followed by hypofunction, either or both of which states may be further characterized by an increase in the size of the gland which, owing to its bony capsule, has little room for growth,



Fig. 2. Postero-anterior head (23°) showing development of frontals and ethmoids.

tober of 1922. While appreciably larger than most boys of his age, his stature was not startling. Perhaps the most striking thing about his appearance was his very long face, and his prominent lower jaw. He wore glasses. His hands and feet were somewhat large in proportion to his general development. Mentally, he appeared to be somewhat superior to the average youth of his age. He presented himself for examination because of a progressive malocclusion of the teeth which had been noticed for the first time eight months before.

The family history was negative. Both father and mother are individuals of average size, considerably smaller than their son. So far as the parents were aware there had been no other instances of abnormal development in the family.

The patient weighed eight pounds at birth, was delicate, and made no gain for nine months. At this time there occurred an abscess in the neck, presumably from a suppurating gland. A partial adenectomy was done at about this time. The child con-

tinued delicate and was much troubled by colds until the age of five years, when tonsils and adenoids were removed, with a resulting striking improvement in general health. From the fifth to the ninth year,



Fig. 3. Lateral head showing depth of frontals.

growth, development and strength were normal, and his health was good. At about the tenth year he began to surpass other boys of his age both in size and strength. The overgrowth at this time was symmetrical and without deformity, the acral parts maintaining a normal relationship to the rest of the body. At the eleventh year he began to have headaches and glasses were fitted which gave quite complete relief. The eye grounds were examined at this time, and pronounced normal. Twice since that time the headaches have recurred, and have been relieved by a change in the glasses. It does not appear that the headaches were ever very severe, nor that they were of the paroxysmal type.

He has had no serious illness except the present one. He complained of no weakness, the headaches had recently been relieved by another change in the glasses, and there had been no polyuria. In short, the sole complaint was the faulty occlusion of the teeth, which had been growing steadily worse since it was first noted.

In general, physical examination revealed no abnormality except the characteristic growth changes. The height was 6 feet 1 inch, the weight 170, and both were stated to have been practically constant since the twelfth year. The hands and feet were rather larger than normal. The supra-orbital region was decidedly prominent and the lower jaw was markedly elongated and protruded. The lower incisors projected well beyond the upper. The upper measurement was 86 cm., the lower 98 cm., and the span 95 cm. There was no noticeable enlargement of joints or epiphyses. The pulse was 76-80 in the sitting posture, the blood pressure 120-78 recumbent, and the temperature 98.4. The external genital organs were not normally developed, being very small. The hair of the head was abundant and coarse. The eyebrows were abundant and met in the midline. The pubic hair was normal in amount and masculine in distribution.

Routine examination of the blood showed nothing abnormal. The Wassermann was negative. The urine was normal. Sugar-tolerance test showed a slight increase. There was no glycosuria either one or two hours after the administration of 1.5 grams of glucose per kilogram of body weight. The fasting blood sugar was .105 grams per 100 c.c.; one hour after the glucose was administered it had risen to .190, while at the end of the second hour it had fallen again to .105. The basal metabolic reading (Sanborn-Benedict apparatus) was -20 per cent.

X-ray study was made of the head, the sella, and the hands. The sella was of normal outline, showed no evidence of erosion, and measured 10 mm. in width by 9 mm. in depth. The hands showed uniform increase in the width and length of all the phalanges. The epiphyses were united. There was slight tufting of the terminal phalanges. There were no exostoses. The frontal sinuses were considerably increased both in area and in depth, and were subdivided into a considerable number of small cells. The inferior maxilla was markedly enlarged and

protuberant. Viewed laterally, the lower incisors projected two or three millimeters beyond the plane of the upper incisors.

The eyes were examined by Dr. J. H. Simpson. He reported no pallor of the discs; a slight haziness of the nasal side of both discs, and a slight, uniform contraction of the visual fields.

Upon the evidence here presented a diagnosis of a transitional form of hyper-pituitarism, gigantism assuming acromegalic characteristics, was made. The progressive growth of the jaw, as well as the absence of weakness, the normal blood pressure and pulse rate, and the normal fat distribution, seemed to indicate that the gland was still over-functioning. The apparent activity of the condition called for some form of treatment, but its moderate severity did not seem to warrant surgical intervention with its rather alarming operative risk. Radiation therapy seemed to be the treatment of choice, and X-ray seemed preferable to radium. Consequently a series of rather short high voltage X-ray treatments was advised, with a view of curtailing gradually the activity of the gland. This program was accepted, and put into execution.

The first—and only—treatment consisted of about one-half an erythema dose of X-rays through two temporal and one frontal port of entry, at 200,000 volts, 5 milliamperes, and 50 cm. skin target distance, employing .75 copper filtration. The patient was directed to report at the end of a month. At this time he was convinced that the growth of the jaw had ceased, so he was dismissed for another month. He did not report in person again, having moved to another city, but one year after treatment his parents stated that the condition had remained exactly as it was when he was first treated, without further progression. There had been no general symptoms, and health and strength remained excellent. There had been no further impairment of vision.

No claim is made that this case was arrested by X-ray. In a condition which in its nature tends to be self-limiting, it would obviously be impossible to say that the treatment did not happen to be administered



Fig. 4. Supero-inferior head showing depth of frontals.

at a time when the hyperfunction of the gland was about to cease spontaneously. However, since the lesion was actively and rather rapidly progressive up to the time of treatment, and since it did then cease to progress and has since remained quiescent, there seems a fair chance that the therapy may have borne an important part.

Eleven years ago, in 1912, Cushing in his book, "The Pituitary Body and Its Disorders," reported a trial of X-ray therapy, in several cases of hyperfunction, based on still earlier work by Gramegna, Bécélère, and Jaugeas. His results were evidently quite encouraging; he stated that in several cases almost complete blindness had been partially relieved. He believed the treatment to be most effective after surgical intervention in the form of sellar decompression. Since that time there have been occasional reports in the literature of radiation therapy in pituitary cases, frequently with apparently good results.

When it is considered that the average sella lies six to eight centimeters from the surface, and that the tissues to be penetrated

include, from any angle of approach, a layer of bone, it would seem that short wave length, heavily filtered X-ray ought to offer



Fig. 5. Showing tufting of phalanges.

a much greater chance of causing hypoplasia of the gland than did the soft, lightly filtered ray of a few years ago. If the therapy of ten years ago did indeed produce favorable results, that of to-day ought to be much more dependable. Since surgery has nothing more to offer than palliation, and that only at the expense of a dangerous, difficult, and mutilating operation, it would appear that X-ray therapy ought to be worthy of trial before surgery, instead of in sequence to it as advocated by Cushing some years ago.

In the more advanced cases the size of the visual field probably offers the best check on any form of therapy. In view of the tendency of the hyperfunction to be replaced, after a time, by hypofunction, it would appear wise to make the dosage fractional except where there is reasonable ground to suspect a malignant tumor as the pathological basis. In mere functional overactivity, overtreatment might be almost as much calamity as no treatment at all, in that it would merely hasten the transition to the second stage of the disease.

Radiation therapy for acne.—After outlining the symptoms, diagnosis, general and local treatment, the author states that, if after a month or two there is no improvement, it is advisable to use X-ray treatment, because in chronic and long-standing cases the infection is too deep in the skin to be reached by local medication.

X-ray treatment can now be so controlled that it is an entirely safe procedure. The time required to cure a case of acne with X-ray varies from ten to sixteen weeks. Treatments are usually given at weekly intervals, using fractional

doses, so that no changes are produced in the normal skin. Little or no improvement is noticed for three or four weeks, then the pustules become more superficial and less indurated, and new ones fail to develop. In the author's practice, there were two relapses in 29 cases treated, and no failures. The average number of X-ray treatments in the 29 cases was 12.2.

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Acne Vulgaris. Roy Blosser. *Rhode Island Med. Jour.*, March, 1924, p. 33.

THE MANAGEMENT OF THE INOPERABLE CANCER PATIENT¹

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WHAT would be the attitude of the medical profession toward a physician who refused to have his patient treated because the consulting internist could offer no hope of curing the sufferer of his stenosed and leaking mitral valves? What would be said of this same physician if he advised the family to have nothing done because the condition was incurable and would eventually kill the patient anyway? How frequent it is for the radiologist to hear the physician, by whom he has been called in consultation, after being advised that there is little or no chance to cure the malignancy, but that lessened pain, increased comfort and probably a lengthened period of life is practically certain, reply, "What's the use of putting him through all this treatment if you can't cure him? We'll give him plenty of morphin and let him die in peace."

Imagine, if you can, the hopelessness of being told, not only that your, or your loved one's, disease is incurable but that there is no use of doing anything, even to increase comfort or lessen pain; that it is not worth while to even attempt to prolong your life for a few months or years of comparative comfort. How often we hear that despairing request, almost a cry, that we do something, make any attempt, just so that we do not abandon them. And then, goaded by our sympathy, we treat one that we believe is beyond even amelioration, only to see the ulcer close, the fetid discharge and pain disappear, while the patient actually thinks that she is getting the better of her cancer until she dies peacefully of cachexia six to eighteen months later. If we were told that we had one chance in a hundred for such a result, most of us would want something done rather than throw away that chance.

We do not expect to cure the chronic cardiovascular diseases. We talk of their

management, not their cure. Have we not talked so much about the cure of cancer that we have neglected those poor unfortunates we never expected to cure, beyond giving some radiation and then telling the family that everything possible has been done?

To draw another parallel with our cardiovascular patient: consider how we should feel toward our colleague who treated a chronic mitral disease with accompanying dilatation and edema by giving digitalis and morphin only, and took no interest in nor gave advice on rest, diet or exercise. Yet we often do this very thing. We give a dose or a series of doses of X-ray or radium and never see the patient afterward. The author believes that the management of the inoperable cancer patient belongs to the radiologist, or to the family physician in continual co-operation with the radiologist, just as the cardiovascular patient's best care is accomplished by the internist or the family physician in co-operation with the internist. If the radiologist is not prepared to consider any portion of the management except the radiation dosage, he is little better than a technician.

If we believe that any benefit resulting from the radiation treatment of cancer is largely dependent on the ability of the body to react against the malignancy after treatment has been given, then any method by which bodily resistance may be increased is of prime importance, and secondary only to the radiation treatment itself.

No discussion of radiation dosage or its indications will be attempted. They have been thoroughly impressed into our journals by many authors. The scope of this paper is a plea to radiologists to interest themselves in other factors beside radiation, bearing on the management of malig-

¹Read before the Radiological Society of North America, Chicago, June, 1924.

nant disease, and to give our impressions of the effect of dietary influences on the wellbeing of these sufferers. This phase of the treatments at the Santa Barbara Cottage Hospital has been either in close co-operation with, or entirely under the direction of, Dr. W. D. Sansum of the Potter Metabolic Clinic. We are still undecided on many points, but the principles involved have worked out so well in practice that we feel they should be used more widely by radiologists in their routine treatment of malignancies.

The same dietary management has also been found very useful in operative cases, but a discussion of these would be out of place at this time.

Acidity in the body to the faintest degree is incompatible with life. We consume what foods we please and the body preserves its alkaline balance by excreting the excess of the acid ash through the kidneys. Urine acidities as great as one hundred times that of the body are very common and occasionally a urine is found which is one thousand or more times as acid as the body.² Practically all our patients were found to have a high urine acidity on entering the hospital, indicating that the body was making definite efforts to preserve the alkaline balance. This was due in many instances to a previous diet, as Blatherwick,³ Sansum² and others have shown that the urinary acidity can be influenced to almost any degree by diet alone. If the acidity was not high on entrance it usually became so immediately on or soon after radiation treatment, especially a little later when the tumor was regressing. Meat of any kind is one of the foods producing an increased acidity of the urine.^{2, 3} An individual with a regressing tumor is necessarily forced to metabolize meat protein in order to get rid of that tumor and, therefore, there is an increased effort required

to maintain the blood alkalinity and this effort is directly proportional to the rapidity with which the tumor is made to regress. It is well known that post-operative cases do better if methods of assisting them to maintain their alkalinity are used and that practically all of those that do not do well have a so-called acidosis. It is also observed that those who suffer from post-radiation vomiting have not only the usual acidosis but, in addition, a starvation acidosis with acetonuria. Because of this we stopped the starvation method (liquid diet) of preventing radiation sickness and placed all patients on a liberal basic diet for as long a period as possible before beginning treatments. We mean by a basic diet one in which the foods used result in producing an alkaline urine. In essence, though not actually in practice, this consists in a meat- (and fish-) free, bread-free, egg-free diet. In addition, we urge the drinking of large amounts of orange juice. Blatherwick and Long,⁴ of the Potter Clinic, have shown that orange juice is especially valuable in combating acidosis and at the same time cannot be taken in sufficient quantities to produce an acid urine by introducing an overwhelming amount of citric acid. The contained sugar also has a high food value in combating any starvation acidosis that may develop from vomiting.

Since adopting a basic diet as routine, radiation sickness has become negligible. It is true that we have reduced the amount of the daily dose, but we have found, especially when irradiating the breast, that those out-patients who neglect the diet list we furnish them are frequently nauseated if not actually sick, while those who follow it closely as a rule complain of malaise only. We are not yet prepared to state just how great a factor this dietary management is in influencing the ultimate result of our treatments. However, we are sure that it is a very large contributing factor

²The Use of Basic Diets in the Treatment of Nephritis. W. D. Sansum, M.D., N. R. Blatherwick, Ph.D., and Florence H. Smith, B.S., *Jour. A.M.A.*, Sept. 15, 1923, Vol. LXXXI, pp. 882-886.

³The Specific Role of Foods in Relation to the Composition of the Urine. N. R. Blatherwick, Ph.D., *Arch. Int. Med.*, Sept., 1914, Vol. XIV, p. 409.

⁴Studies of Urinary Acidity. I. Some Effects of Drinking Large Amounts of Orange Juice and Sour Milk. N. R. Blatherwick and M. Louisa Long, *Jour. Biol. Chem.*, July, 1922, Vol. LIII, p. 103.

in promoting the wellbeing of our patients, and work to determine its definite effect on the progress of our cases is under way.

Another difficulty frequently encountered, especially with cachectic individuals, is the absence of appetite and the ability to digest food hardly sufficient in calories to maintain life at bed rest. A short time ago Dr. Sansum found that one of his diabetic patients who was receiving insulin could not take sufficient food to supply calories beyond the bed rest amount without developing intestinal distress and diarrhea. On the supposition that the long-continued bodily weakness of this patient, due to the extremely limited diet possible before the use of insulin, extended to the digestive glands also, thus setting up a vicious circle, he began the use of pancreatic extract. This was given in capsules in the usual dosage without result. Pancreatic extract as a by-product in the manufacture of insulin is available in large quantities at the Potter Clinic, and had been thrown away. Reasoning that a certain proportion is probably digested and therefore not available, he increased the amount from day to day. A point was finally reached where it became effective. The patient immediately not only ceased to have the intestinal distress but developed an appetite and took care of sufficient food to enable him to gain weight and be up and about. When this point was reached the use of the pancreatic extract was stopped and, as was hoped, found no longer necessary. Following this experience of Dr. Sansum the author has used pancreatic extract in several cases of malignancy with cachexia and anorexia. The results were startling. In every case after forty-eight hours the patient complained of not getting enough to eat and at the same time showed no distress from this sudden increase in the diet, which in one instance was nearly doubled. The amount of extract used in these cases was one gram or more before each meal and the effect was first noted on the second or third day.

In closing, we wish to repeat that we are not in position to speak of this dietary management in absolute terms as far as prolonging life is concerned. We do feel, however, that it has been distinctly useful and, therefore, present it with the hope that others may use it and assist in determining its definite value.

The following paragraphs are taken from Dr. Sansum's article on "Basic Diets in the Treatment of Nephritis" and are the basis upon which we regulate the diet of our cancer patients.

All foods may be classified, with respect to their final effect on the body, as neutral, acid or alkaline. Such lists of foods have been prepared by Sherman and Gettler from ash analyses and tested in man by Blatherwick. The accompanying tables have been prepared from their work.

The Neutral Foods.—These may be used in the amounts desired by the patient, unless otherwise stated. They are: butter, cornstarch, cream, lard, sugar and tapioca.

The Acid-producing Foods.—Many of these foods should not be used. A few of the less acid ones may be used in the amounts specified for each case.

TABLE 1—*Acidity of Certain Foods*

	PER HUNDRED GRAMS
Bread, white	2.7
Bread, whole wheat	3.0
Corn, sweet, dried	5.95
Crackers	7.81
Cranberries ⁵	
Eggs	11.10
Egg white	5.24
Egg yolk	26.69
Fish, haddock	16.07
Fish, pike	11.81
Meat, beef, lean	13.91
Meat, chicken	17.01
Meat, frog	10.36

⁵The ash of these foods is alkaline, but because of contained substances which form hippuric acid in the body, they increase the acidity of the urine.

TABLE 1—*Acidity of Certain Foods—*
Continued

	PER HUNDRED GRAMS
Meat, pork, lean.....	11.87
Meat, rabbit	14.80
Meat, veal	13.52
Oysters	30.00
Oatmeal	12.93
Peanuts	3.9
Prunes, plums ⁵	
Rice	8.1

The total excess of acidity over base is expressed in terms of cubic centimeters of a normal solution.

The Base or Alkali-producing Foods.—In general, all vegetables, nuts, fruits and sweet milk, with the exception of prunes, plums and cranberries, are basic in their final reaction. These may be used in the amounts desired by the patient. The total excess of base over acid is expressed in terms of cubic centimeters of a normal solution.

TABLE 2—*Alkali-producing Foods*

	PER HUNDRED GRAMS
Almonds	12.38
Apples	3.76 ⁶
Asparagus81
Bananas	5.56 ⁶
Beans, dried	23.87
Beans, lima, dried.....	41.65
Beets	10.86
Cabbage	4.34
Carrots	10.82
Cauliflower	5.33
Celery	7.78
Chestnuts	7.42
Currants, dried	5.97
Lemons	5.45
Lettuce	7.37
Milk, cow's	2.37
Muskmelon	7.47 ⁶

⁵See Note 5, p. 499.

⁶These foods have been found experimentally to be very efficient in reducing the acidity of the body.

TABLE 2—*Alkali-producing Foods—*
Continued

	PER HUNDRED GRAMS
Oranges	5.61 ⁶
Peaches	5.04
Peas, dried	7.07
Potatoes	7.19 ⁶
Radishes	2.87
Raisins	23.68
Turnips	2.68

Teaching Notes.—1. A fruit served with cream is used as a substitute for a breakfast cereal.

2. Three half slices of toast may be served at breakfast, and bread omitted for dinner and supper.

3. Cornstarch is used as a thickener for cream sauce, soups, etc.

4. Lemon juice is substituted for vinegar in salad dressings.

5. Fat in the form of butter, cream, olive oil, etc., is used in sufficient quantities to regulate body weight.

6. The bulk of the diet is regulated to produce a normal bowel movement each day.

TABLE 3—*A Basic (Alkaline) Diet*
(as served)

BREAKFAST

Baked Apple with Cream	
Bacon	
1/2 Slice Toast	Butter
Jelly	
1 Glass Orange Juice	1 Glass Milk

LUNCH

Baked Stuffed Potato	Beets in Cream
Combination Vegetable Salad	
1/2 Slice Bread	Butter
Iced Cantaloupe	Olives
1 Glass Orange Juice	1 Glass Milk

TABLE 3—*A Basic (Alkaline) Diet*
(as served)—Continued

DINNER

Cream of Spinach Soup	
Escalloped Potatoes	
Buttered Peas and Carrots	
California Fruit Salad	
1/2 Slice Bread	Butter
Apricot Ice Cream	
1 Glass Orange Juice	Raisins
Nuts	

DISCUSSION

DR. G. E. PFAHLER (Philadelphia): I would like to ask Dr. Ullmann to please give the diet list that is being published and has worked out so well; if he will give it to us in detail, perhaps we can make use of it.

DR. ULLMANN (closing): In regard to the diet list, I have referred to it as published in the *Journal of the American Medical Association* for September 15th. I will say, however, that the two tables, giving the acid ash foods and the alkaline ash foods, are of considerable interest and it has been requested that I include them in this paper when printed, and I will do so. In using these tables you will see that there are certain figures after the name of each food; these state the proportion of acidity or alkalinity of the ash. For instance, if you have a meat with an acidity of 100 and a basic food with an alkalinity of 100, and feed those two in the same quantity, they neutralize each other. When I say meat-free, egg-free, bread-free diet, I mean that you can give them if you give enough of the alkaline foods, orange juice, for instance, to counteract the effect of their acid ash.

Hypertrophic arthritis.—Some uniform classification of types of arthritis must be adopted. The one which seems most suitable is infectious, atrophic, and hypertrophic.

The present discussion of hypertrophic arthritis is based upon definite bony changes, consisting of new bone formation, as found in a series of 625 spinal columns examined in the Hamann Museum.

SUMMARY

Hypertrophic bone changes represent the reaction of bone and joint structures to the wear and tear of life. They are more pronounced in certain types of individuals and are aggravated by continued local irritation of any character.

These changes rarely occur before the thirty-fifth year of age, but are progressive thereafter.

They may exist to a marked degree without clinical symptoms. Being the result of metabolic changes rather than the cause, their presence does not prohibit relief from such symptoms.

The bone changes are permanent. Treatment of the symptoms must be directed toward the removal of all possible sources of continued irritation. These include mechanical strains, focal infections, intoxications, and absorptions, any or all of which factors may be present in a given case.

L. R. SANTE, M.D.

The Age Factor in Hypertrophic Arthritis.
Theodore A. Willis. *Jour. Bone and Joint Surg.*,
April, 1924, p. 316.

ADVANCED TROUBLE SHOOTING

TESTING THE TRANSFORMER

By C. B. HORSLEY, PITTSBURGH, PA.

OF all X-ray equipment, the transformer is, without a doubt, the most unjustly and falsely accused. Whenever there is trouble with the equipment that the doctor or electrician cannot locate, the transformer invariably gets the blame.

It is very seldom, indeed, that there is any real trouble in the transformer. The list of items, which more or less frequently succeed in "passing the buck" to the transformer, varies from a blown fuse to a short circuit in the Coolidge circuit.

There seem to be several popular indications for transformer trouble:

- (1) Apparently no current passes through the transformer.
- (2) The transformer seems to be overloaded, hums loudly and blows out fuses.
- (3) The filament does not light.
- (4) The oil in the transformer boils over (real trouble).

A great number of the cases exhibiting the first type of symptoms can be permanently cured by renewing a blown fuse. Be sure that the new fuse, put in to take the place of the blown fuse, is good. After a doctor has spent several hours attempting to determine the source of the trouble, if someone suggests that a fuse may have blown, he is almost insulted; but it continually happens that a blown fuse is overlooked. The best way to dispel all illusions as to whether or not current is being supplied to the transformer is by the use of a test lamp. Connect one 220-volt, or two 110-volt lamps in series, across the primary terminals of the transformer, then proceed, as you would customarily, to energize the tube. If the lamp or lamps do not light, you can generally assume that the trouble is in a circuit breaker, a fuse or a loose connection somewhere in the primary circuit. If the lamps light and there is no hum or sign of life from the

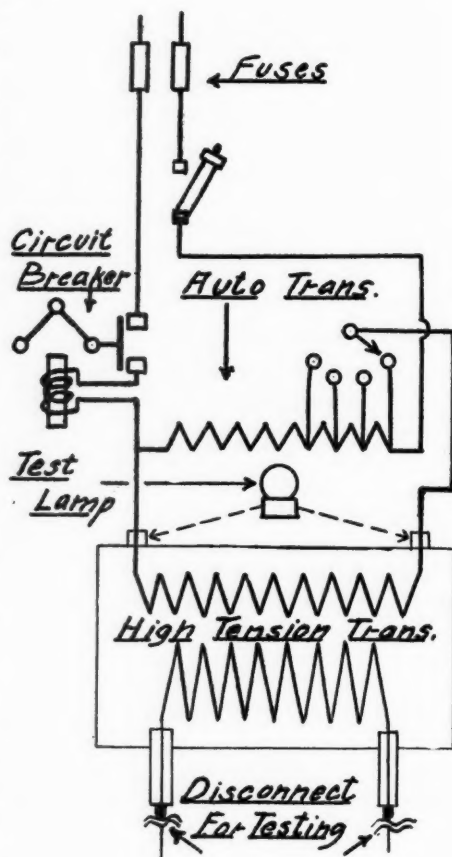


Diagram Showing Points for Disconnecting Secondary and for Connecting Test Lamp

transformer, the trouble might safely be said to be in the transformer. With some types of apparatus the primary terminals of the high tension transformer might not at first be apparent, but this difficulty may be overcome either by the use of a wiring diagram or by tracing out the wiring of the apparatus.

The second type of symptoms, that is, when there is an excessive humming in the transformer and no current is delivered to the tube, seems to indicate that the transformer is shorted or grounded inside. In such a case it is advisable, first, to examine all wall insulators or other type of tube insulators which insulate the high tension wires from each other or from the ground. As a final test, remove all connections from the high tension terminals of the transformer. If, when the current is turned on, the excessive humming still continues, the trouble is in the transformer. If disconnecting the high tension terminals of the transformer relieves the trouble, there is a short or ground in the high tension or aerial system.

The third case, apparent trouble with the filament transformer, presents itself on more occasions than either of the above cases. In testing out the filament transformers, practically the same procedure should be carried out as that outlined above for testing the high tension transformer. After it has been made sure that current is being fed the primary of the filament transformer, disconnect all leads on the secondary (low tension side) and see if a spark may be obtained by touching one of the low tension terminals with a wire connected to the other low tension terminal. If there is a spark it is safe to say that the

transformer is all right, and that, provided the tube is good, the trouble is in the Coolidge circuit.

In transformers, such as the Army type of portable, where the Coolidge circuit can be turned on only when the high tension circuit is turned on, this spark may be tested for by the use of a wire tied to the end of a dry piece of wood about two feet long.

Incidentally, the Coolidge circuit is probably the source of more trouble than all the rest of the apparatus put together, and will be dealt with further in a following article.

In the fourth case, if the oil boils over, there is trouble in the transformer. In some instances where the overheating has been caused by an overload, if the oil is filtered and new oil added to take the place of the oil that was lost, the transformer may still be used, but in most cases damage has been done to the windings.

If all other causes have been eliminated and the trouble has been definitely located in the transformer, it should be shipped back to the factory for repairs. If there is someone on hand who is really capable of repairing the transformer and who has the necessary equipment, he may be consulted, but such a condition is very seldom encountered.

Skin cancer.—In the treatment of rodent ulcer of the face and head with radium, the flat applicator is most convenient. By using the quarter strength applicator (2.5 mg. per sq. cm.) for from three to six hours, necrosis of the malignant tissue will result, followed by slow healing in five or six weeks, leaving a smooth, supple scar. In 426 cases of these lesions seen since 1910, there have been 371 (87.08 per cent) clinical cures.

The squamous-cell epithelioma is more malignant and tends to form metastases. If it is of the fungating type, remove the cauliflower

excrescences and apply radium to the base and surrounding areas, using a powerful destructive exposure. If the growth is of the pavement type of epithelioma, treatment should be through 1/10 mm. of lead, extending the radiation into the surrounding tissues. In these lesions, 75.47 per cent are clinically cured.

In epithelioma of the lip, out of 142 cases, 113 are clinically cured.

W. W. WATKINS, M.D.

Radium Treatment of Skin Cancer. Frederick C. Harrison. Canadian Practitioner, March, 1924, p. 169.

MEASUREMENTS OF THE QUALITY AND QUANTITY OF X-RAYS IN DEEP THERAPY

By ERNST A. POHLE, M.D., CLEVELAND, OHIO

From the X-Ray Department of Mount Sinai Hospital

LORENZ and Rajewski (1) have published measurements recently of the absorption coefficient¹ in aluminium and water and have found, by using a very exact method, the corresponding values of μ_{Al} and μ_{H_2O} . They also showed that methods used in ordinary practice resulted in different values for the coefficient. It is, furthermore, a fact that the measurements of different authors using machines of the same type and Coolidge tubes do not agree at all. This is shown in Figure 1, where

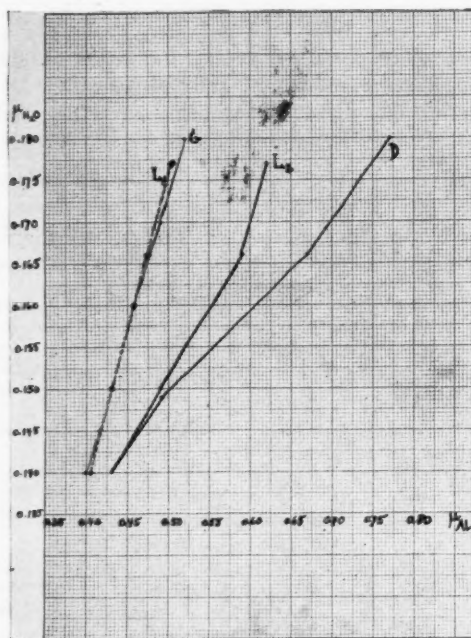


Fig. 1

the corresponding results of μ_{Al} and μ_{H_2O} of several investigators are given.

Very interesting is the comparison of the

¹This absorption coefficient is, in fact, the coefficient of weakening: $\mu = \mu_a + \sigma$ in which formula μ_a is the absorption coefficient alone and σ the scattering coefficient.

curves of Glasser² and Lorenz (1 and 2). It shows that the curves G and L (1) are identical. This explains partly the discrep-

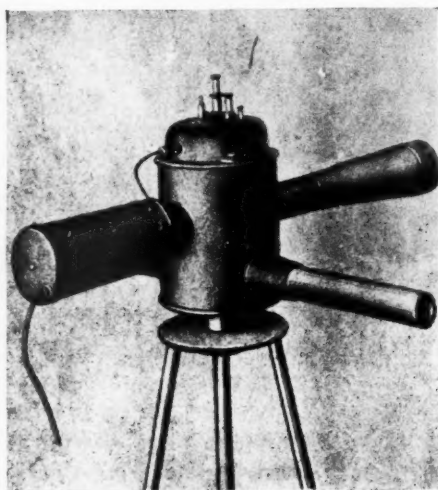


Fig. 2

ancy in values of μ_{H_2O} measured on foreign and American transformers. The curve L₂ shows that any of the values of μ_{Al} measured with the usual method corresponds with a totally different value of μ_{H_2O} than those recorded with the exact methods of Lorenz and Rajewski, who very carefully selected the central ray beam. If Glasser finds, for instance, at 200 KV. and 0.75 Cu. + 1.0 Al., the $\mu_{H_2O} = 0.18$, calculated from μ_{Al} (measured with the usual method) = 0.52, this corresponds with a μ_{H_2O} of 0.155, using the results given by L. and R. (last column in Table No. 5, *loc. cit.*). This latter value comes very close to the results generally recorded by German authors—Dessauer (4).

I further mention Weatherwax and Leddy (2), who find at 200 KV., 1.3 Cu. +

²This curve is not published and I am obliged to Dr. O. Glasser for the communication of his results.

1.0 Al. the $\mu_{\text{H}_2\text{O}} = 0.137$, while Jaeger and Rump (3) measured $\mu_{\text{H}_2\text{O}} = 0.191-0.188$ at 175 KV., 3 ma., 0.5 zinc + 2.5 Al.

There may be two reasons for this discrepancy. The different machines and tubes produce rays of different quality or the methods of testing are not quite correct. For instance, the question has been asked frequently, if aluminum can be used as an exact measuring material for radiation of short wave lengths. It is said that the measurements lead to inaccurate results owing to the unfavorable proportion of absorption and scattering—Kuestner (5). In order to explain these differences in the measurements on German and American transformers we have made a number of tests using the Kelley-Koett 280 KV. transformer, a German A E G Coolidge tube and an electroscope (Winawer - Back)³ standardized in the Gynecological Clinic of the University of Frankfort O/M (Director: Prof. Seitz).

To charge the electroscope, a special charging device⁴ constructed by Brenzinger (6) was used (Fig. 2). The principles of its construction and its proper use are shown in Figure 3. A capacity formed by the metal plates S_1 and S_2 separated by a dielectricum D is charged when S_2 is pressed against S_1 (the latter is grounded in E) by direct current (St—KS) at H . If the dis-

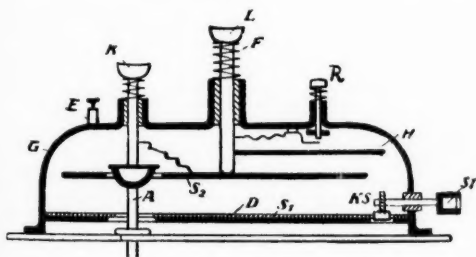


Fig. 3

tance between the two plates is increased, the capacity decreases but the potential increases. The electroscope is now to be connected with the capacity by pushing down

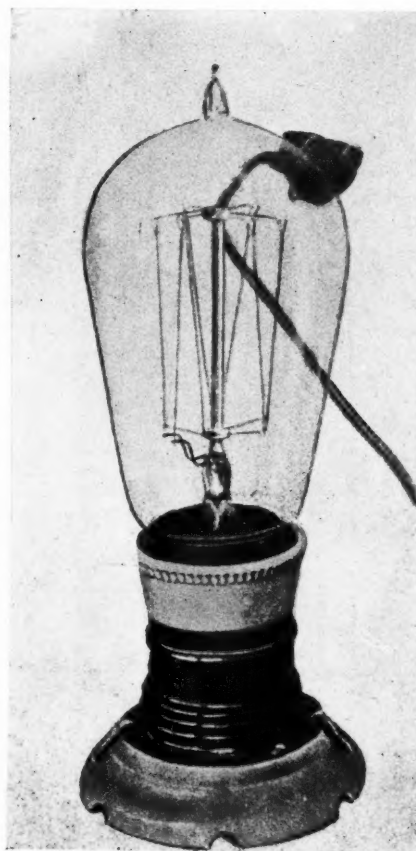


Fig. 4

the lever A-K. The degree of charging or discharging may be regulated by raising or lowering the plate S_2 with button LF. The discharge takes place by pressing button R. If there is only alternating current available the ordinary electric bulb which lights the scale can be used as a valve by inserting an electrode (Fig. 4).

The method of the testing is shown in Figure 5. This arrangement was chosen with intention, for it is similar to that used in practice. It should never be forgotten that testing of tubes in a deep therapy institute is a secondary procedure to the physician. In order to find the values of $\mu_{\text{H}_2\text{O}}$ which correspond with the μ_{Al} measured in the tests, the last column of Table V, page 894, in the paper of Lorenz and

³This instrument is built by the Veifa-Werke, Frankfort O/M.

⁴Built in the Dessauer Institute, University of Frankfort O/M.

Rajewski was used. In the following Table I our results are presented. Each test was done at 2, 3, and 4 ma.; for comparison, the values of the effective wave length⁵ are also given, as found by measuring under the mentioned conditions. We

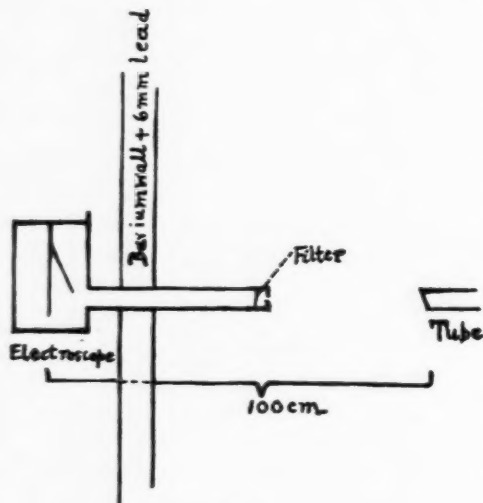


Fig. 5

tried to avoid all known errors of those tests. The tube was always kept running about one hour before starting the measurements; the same parts of the scale were used; the mean value of at least three readings are used for the calculation. The leakage of the electroscope was so small that it could be completely neglected. The peak voltage was controlled with a standard sphere gap with the tube parallel to it.

From the results given in Table I, we see that the values for μ_{H_2O} under the arrangements used in the tests vary quite a bit, although all readings were taken by the same observer, to avoid the personal error. The figures agree much better for the effective wave lengths, the constancy of which proves that there is no great difference in the quality of the X-ray beam at various amperages, or, in other words, it seems that the output of the transformer is not changing much by increasing the current through the tube. A

comparison of the $\mu_{Al} = 0.46$ at 200 KV. and 1.3 Cu. + 1.0 Al. on the American machine with the $\mu_{Al} = 0.42$ of the Dessauer transformer seems to indicate that the latter produces a radiation of slightly better quality ($\mu_{H_2O} = 0.145$ [Kelley-Koett] and $\mu_{H_2O} = 0.139$ [Dessauer]). But this is certainly not enough difference to be of a great importance in practice.

An observation made during these tests at different M amperages but the same voltage and filter led us to check up the ratio of the intensities of X-ray beams at 1, 2, 3 and 4 ma., keeping the same voltage and filter. For these measurements the wide tube and wide opening of the electroscope were used. It was to be expected that the intensities would increase arithmetically with the ma., or the discharging times decrease in the same ratio. In Tables II and III our results are shown and it is evident that this simple law does not hold true. Therefore it is not correct to calculate from an erythema time known at 2 ma. another one at 4 ma. by using half the exposure. The only exact procedure is to make the actual tests on the tube. Our results are in disagreement with the measurements of Wacker (7), who finds on the neo-intensive transformer with Coolidge tubes at 4 ma. the discharging times of the electroscope shorter than the time at 2 ma. divided by two. This seems to correspond with the impression of Duane (8), who says that the U. S. D. at 2 ma. requires *more* than double time as at 4 ma.

CONCLUSION

Measurements of the quality and quantity of X-rays using an American transformer (Kelley-Koett), a German Coolidge tube, and a standardized electroscope show that:

1. The μ_{Al} is only to be used with great precaution in practice.
2. The method of Duane (effective wave length) is more to be recommended to the physician for expressing the quality of his radiation.
3. It is not correct to calculate erythema times at different M amperages. The E. T.

⁵Duane: Am. Jour. Roentgenol. and Rad. Ther., March, 1922, Vol. IX, p. 167.

TABLE I

	KV.	Cu.	Al.	KV.	Cu.	Al.	KV.	Cu.	Al.	KV.	Cu.	Al.	KV.	Cu.	Al.
	150	0.5	1.0	160	0.5	1.0	180	0.8	1.0	200	1.0	1.0	200	1.3	1.0
Ma.	μ_{Al}	μ_{H_2O}	λ_{eff}	μ_{Al}	μ_{H_2O}	λ_{eff}	μ_{Al}	μ_{H_2O}	λ_{eff}	μ_{Al}	μ_{H_2O}	λ_{eff}	μ_{Al}	μ_{H_2O}	λ_{eff}
2	0.63	0.18	0.167	0.66		0.163	0.56	0.161	0.152	0.506	0.151	0.143	0.46	0.145	0.136
3	0.71		0.167	0.63	0.18	0.163	0.54	0.157	0.152	0.50	0.151	0.143	0.48	0.148	0.136
4	0.69		0.167	0.69		0.163	0.537	0.156	0.152	0.50	0.151	0.143	0.49	0.149	0.136

are not inversely proportional to the number of ma., provided an ordinary X-ray machine is used.

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TABLE II

	150 KV.	160 KV.	180 KV.	200 KV.	200 KV.
Ma.	0.5 Cu.	0.5 Cu.	0.8 Cu.	1.0 Cu.	1.3 Cu.
2	38.9 [†]	27.4	30.9	26.6	31.3
3	28.1	24.4	22.5	19.3	23.6
4	25.5	20.2	18.8	17.5	21.2

TABLE III

(200 KV.)

Filter	1 Ma.	2 Ma.	3 Ma.	4 Ma.
0.5 Cu.	74.4 [†]	20.4	14.8	12.5
0.8 Cu.	84.7	24.3	18.4	15.4
1.0 Cu.	93.8	29.4	21.3	18.1
1.3 Cu.	102.1	33.0	26.3	22.7

G = curve for the calculation of μ_{H_2O} from μ_{Al} , as given by Glasser.

L₁ = the same (using the central ray beam), as given by Lorenz.

L₂ = the same method of measurement (as used in practice).

D = the same curve, as given by Dessauer (1919).

[†]Discharging time in seconds.

DEPARTMENT OF RADIODONTIA

UNDER THE SUPERVISION OF BOYD S. GARDNER, D.D.S.,
ROCHESTER, MINNESOTA

THE X-RAY AS A MEANS OF SAFEGUARDING THE ANTRUM OF HIGHMORE DURING EXTRACTION OF TEETH

By BOYD S. GARDNER, D.D.S., Section on Dental Surgery, Mayo Clinic, ROCHESTER, MINNESOTA

PATIENTS with chronically infected antrums and histories of surgical interference by the dentist are apparently on the increase, possibly because to-day the X-ray is being used more routinely in oral examinations, which produces definite data. Roots, and pieces of alveolar processes which have been pushed into the

antrum of Highmore at the time of extraction are often found, and occasionally an entire tooth is found. The anatomic variation of this antrum, especially from the standpoint of size, accentuates the necessity of X-ray data at the time of removal of maxillary bicuspid and molars, and even of cuspids in some instances. It is not un-

common for an impacted upper third molar to be lost in the antrum at the time of extraction.

It is well recognized that the antrum may be infected by teeth even before they have been subjected to dentistry. However, only the group of cases in which the opening of the antrum might have been prevented by pre-operative roentgenograms will be discussed here.



Fig. 1



Fig. 2

Figures 1 and 2 emphasize the anatomic variations of unusually large antrums, and not until the so-called open view operation was used in extracting teeth was it possible to obtain definite data as to what took place when roots and pieces of processes were pushed through. The roentgenograms do not always reveal the exact condition, yet they are the best means of determining the relationship of the antrum to the roots of the teeth. In patients with unusually large antrums the lingual root of the first molar is generally well separated from the two buccal roots, and the floor of the antrum

drops between to the point of bifurcation. Hence, the roentgenogram cannot reveal the exact relationship of the roots as they superimpose the lowest portion of the antrum; however, if several exposures are made from different angles, it is possible to make a diagnosis.

Many operators consider it more important to make use of the roentgenogram in operating in the region of the antrum than in removing an impacted lower third molar. This may be somewhat exaggerated; however, the healing of an infected antrum and the closing of large fistulas in many instances are very difficult, and often require the skill and co-operation of a plastic surgeon and a prosthetic dentist. From the patient's standpoint, a chronically infected antrum is most undesirable.

The pre-operative roentgenogram does not prevent the opening of the antrum at the time of extraction, but it acts as a warning, especially in cases in which the antrum is abnormal. By retracting the soft tissues, the operator is able to compare the X-ray findings with the anatomic conditions as they actually are, and as he actually sees them, and the result of his operation should be better than it otherwise would be.

If the roots penetrate the antrum, or if the floor is broken through in extraction, the necessary repair that will tend to be permanent may be made immediately. On the other hand, in many instances, if teeth are simply "pulled," without the aid of the X-ray, the operator usually does not know whether or not he has made an opening, and if he does know, he cannot estimate the amount of damage. A root or a piece of process may be pushed through without his knowledge, and the patient dismissed. It is obvious that, sooner or later, without the use of the X-ray, there may be trouble.

The use of the pre-operative roentgenogram should be emphasized as a means of safeguarding the antrum when extracting teeth, and the post-operative roentgenogram is likewise necessary, as it is the only means of ascertaining the presence of roots, pieces of processes, or foreign bodies.

ACUTE DILATATION OF THE STOMACH¹

ECTASIA, OR GASTRECTASIA, AS IT IS SOMETIMES CALLED

By W. E. HART, M.D., LOS ANGELES

THIS paper is presented, not to advance new theories of pathogenesis or treatment, but with the hope that in the course of reviewing the subject, interest in solving the problems involved may be stimulated. It may be said that the subject is of little importance to the roentgenologist as we rarely see this condition in our laboratories. A brief perusal of the literature should soon convince you that acute dilatation of the stomach has been often erroneously diagnosed, and often overlooked altogether, so that it is possible that the X-ray may be of service in avoiding at least some of these mistakes.

HISTORY

To Hilton Fagge is ascribed the credit of first describing the clinical phenomena of acute dilatation of the stomach. It might be well to record that about the year 1835, Chomel is reputed to have described the "bruit de clapotage," and Kuessmaul is awarded the credit for inventing the stomach pump about the same time. The "bruit de clapotage," or succussion splash, is of considerable diagnostic importance, and the stomach pump or tube is of very great value in the treatment of acute dilatation of the stomach. Since the publication of Fagge's article numerous cases have been recorded, many articles have been written by competent clinicians, and many experiments have been conducted by workers in the field of physiological chemistry and experimental medicine, all concerned in solving the problems involved. Thompson, Connor, Borchgrevink, Doolin, Finsterer, Isidore Cohn, Novak, Boas, Dragstedt (Carl A. and Lester R.), and several others have made valuable contributions looking to their solution.

ETIOLOGY

Acute dilatation may occur at any age, Halat recording a fatal case in a new-born babe, and Moore, one occurring in a woman of 86. In the incidence of sex, the female seems to have a slight advantage, 60 per cent occurring in females, according to one writer. It may arise in the course of a great variety of clinical conditions.

Boas has set down seven different types according to etiology.

1. Cases occurring after dietetic errors, such as would cause an overdistention of the stomach.
2. Those arising in the course of the infectious diseases.
3. Those occurring after exhausting diseases, typhoid, tuberculosis, etc.
4. Those following laparotomies under general narcosis, these being partially analogous to post-operative intestinal paralysis, the etiology of which is still unexplained.
5. Those due to trauma, from blows over the abdomen, and injuries to the spinal column and cord.
6. Those after chloroform narcosis alone, probably by way of central paralysis.
7. Those associated with a mechanical kinking of the pylorus, or jejunum, or from acute obstruction of the pylorus, such as from gallstones perforating into the pylorus (a very rare cause probably).

Finsterer adds abnormal fermentation with gas formation, and also refers to the cases of acute post-partum gastric dilatation reported by obstetricians.

There is an interesting series reported associated with diseases of the spine, Pott's disease, etc.

¹Read before the Radiological Society of North America, Rochester, Minnesota, December 3-7, 1923.

Several cases have occurred following operations on extremities.

Kelling, in 1901, observed a case which was attributed to excessive laughter and also one which followed the application of a plaster cast for scoliosis immediately after a hearty meal of mutton, beans, and raw pears; Connor, one after applying a plaster cast for kyphosis.

Harrigan saw two cases occur during laparotomies. Finsterer states that A. Payer found it to exist in slight degree after almost every laparotomy done in narcosis.

Doolin collected 188 cases, due to all causes, 69 per cent of which were post-operative. Borchgrevink in 1913 gave 66.6 per cent as post-operative, and Laffer in 1908, 38.2 per cent.

Quoting Novak, the analysis of Borchgrevink's 92 post-operative cases shows:

- 71 after laparotomy
- 21 after extra abdominal operations
- 30 after operations on female generative tract
- 17 after operations on gall bladder
- 8 after operations on appendix
- 3 after operations for hernia
- 6 after operations on stomach (one pyloric resection)
- 4 gastro-jejunostomies
- 1 gastro-duodenostomy
- 5 after operations on the kidneys
- 8 after operations on the extremities
- 1 after operation on the face
- 6 after operations on the thorax

Linke, in 1914, stated that over 200 cases of acute dilatation of the stomach had been reported, but he was able to get sufficient details for analysis in only 173.

There were 95 deaths, with 78 recoveries, a mortality of 54.9 per cent

105 cases followed operation and narcosis, mortality 48 per cent

68 cases without operation or narcosis

47 proved fatal, a mortality of 69.1 per cent

67 of the cases operated upon were laparotomies, classified thus:

- 22 on female generative organs
- 18 on bile passages
- 12 on stomach
- 10 on intestines

7 on kidneys

5 after herniotomy

9 after operations on extremities

In the cases not preceded by operation and narcosis:

In 11 there was emaciation, debilitating illness, etc.

In 1 it occurred after giving birth to twins

In 16 it followed errors of diet (overloading stomach)

In 11 there was tuberculosis, one of these being associated with an error of diet, and two with cord disturbance following caries of the spine

In 18 there was septic or infectious disease (typhoids)

9 followed trauma, such as blunt violence to abdomen, or fall on the back, etc., and in one case the cause was unknown

Two theories are advanced to explain the phenomena of acute dilatation of the stomach:

I. A primary paralysis of the stomach.

II. A primary arterio-mesenteric duodenal occlusion with secondary dilatation of the stomach.

According to Isidore Cohn, Brinton, in 1859, was the first to offer the theory of primary paralysis of the stomach and Kundrat, in 1895, was the first to describe an incarceration of the duodenum between the mesenteric artery and the vertebral column as an autopsy finding in three cases of acute dilatation of the stomach.

I. Primary gastric paralysis has been explained in various ways.

1. From local interference with nerves following trauma over abdomen, or in diseases of, or injuries to, the spine.

2. Remote effects of toxins on the central nervous system as a result of typhoid, tuberculosis, pneumonia, scarlet fever, etc.

3. Toxic effect of chloroform, by way of central paralysis. In this connection Finsterer remarks that both acute gastric atony and arterio-mesenteric duodenal occlusion following operations are much less frequent than formerly, which fact he

attributes to the almost total disuse of chloroform as an anesthetic. Chloroform, he holds, is much more likely to be followed by acute dilatation than is ether.

II. Arterio-mesenteric duodenal occlusion.

By arterio-mesenteric duodenal occlusion is meant that form of duodenal occlusion in which the duodenum is compressed by the mesentery of the jejunum, or by the artery running into it, or both, which causes a damming back of the gastric and duodenal secretions, thus causing dilatation of the stomach.

The preponderance of opinion, supported by experimental evidence, and autopsy findings, is in favor of a primary paralysis, local or central in origin, with a secondary arterio-mesenteric duodenal occlusion.

It has been thought by some that excessive gastric secretion is primary and gastrectasia secondary.

Carrion and Hallion, in 1895, found that section of vagus in animals resulted in acute dilatation of the stomach.

Dragstedt, as a result of observations on experimental animals, says: "Although the operation has been performed a great number of times in the study of different problems, a section of both vagus and splanchnic nerves has never, in our experience, produced a dilated stomach with adverse symptoms."

To again quote Dragstedt, the theory supported by Borchgrevink that there occurs a primary gastric dilatation and secondary mechanical occlusion of the duodenum, either by the direct pressure of the stomach on the duodenum in its passage over the spine or by a secondary arterio-mesenteric compression brought about by the downward pressure of the dilated stomach which forces the small intestine into the pelvis, is supported by these experiments. There is no conclusive evidence that an arterio-mesenteric occlusion of the duodenum as a result of a long and dependent mesentery

can ever cause a dilatation of the stomach, although, as will be seen, it may cause a severe toxemia.

Harrigan, in 1916, formed an hypothesis to explain the mechanism of acute dilatation on the assumption that it is caused by paralysis, inhibition, or failure of function, which is toxic in nature. He assumes that a nerve center plexus capable of acting as a nodal center, exists in the wall of the duodenum, from which arise the impulses which initiate the degree and extent of the peristalsis of the duodenum. There is, he says, a striking similarity in point of symptoms between acute dilatation of the stomach and high duodenal obstruction as seen in animal experiments.

SYMPTOMS

The symptoms such as vomiting, thirst, scanty urine, and rapid collapse, which often make it difficult to distinguish the condition from perforative peritonitis or intestinal obstruction, are those of a severe toxemia rather than a result of reflex or mechanical effects from the stretched and dilated stomach (Dragstedt).

Vomiting is usually the first symptom noticed, and is present in practically all cases. Complete absence of vomiting was reported in the *British Journal of Surgery* (author not stated), in 1921, complicated with malignant disease of the head of the pancreas, with involvement of the bile ducts. Vomiting is usually frequent at first, may even be incessant, or remissions may occur lasting several days, or it may cease altogether, though the dilatation may still be extreme. Finsterer reports such a case, in which he removed five and a half liters of fluid after vomiting had ceased. In this connection Fagge remarks: "Hopes raised by intermissions are often false, cessation being due to paralysis of the muscular coat. Vomiting may cease following rupture of the over-distended stomach (such a case is reported by Steinman), there being no pathological changes demonstrable at the margins of the tear. Cessation of vomiting has been reported as a re-

sult of occlusion of the cardia due to the pressure of stomach contents."

One case of gangrene is reported from interference with the circulation, resulting from over-distention.

In one-third of Borchgrevink's cases, vomiting commenced within the first two days after operation.

In 19.....	third day
In 5.....	fourth day
In 4.....	fifth day
In 1.....	sixth day
In 2.....	seventh day
In 1.....	twenty-fourth day

Jessop (reference not given) reported a case as late as the thirtieth day. The quantity of fluid vomited, which may be out of all proportion to the intake, is usually greenish or brown in color, and not as a rule feculent and may be enormous. It may be accompanied by little or no retching, but may seem to regurgitate or overflow, and gives little or no relief.

According to Dragstedt the increase is due to the action of so-called secretion bodies which may be obtained from the duodenal mucosa, and which have a striking effect on the secretion of gastric and pancreatic fluid. This fluid usually contains bile (Dragstedt). Lactic acid has been found by some, and Regnier, in 1905, found hyperchlorhydria in several cases. Absence of free HCl was noted in one of Novak's cases.

The capacity of the normal stomach is variously stated from 250 to 1,650 c.c. (Ewald).

Pain, more or less, is always present, and may be very severe. According to Boas, thirst is a constant symptom and is due to the dehydration. The urine is scanty, sometimes simulating uremia, due also to the dehydration and toxemia. Temperature is not, as a rule, increased in uncomplicated cases, and may be subnormal.

Pulse is usually rapid and small.

Respirations are frequent, agitated and superficial.

Collapse rapidly occurs in severe cases.

PHYSICAL EXAMINATION

Abdomen may be slightly or greatly distended, distention sometimes asymmetrical. Muscular rigidity absent in large majority of cases. Visible peristalsis largely absent. Left diaphragm may be raised, and heart displaced to the right. Succussion splash noted frequently. High degree of tympany unusual. Liver dullness may entirely disappear.

DIAGNOSIS

From post-anesthetic vomiting, perforative peritonitis, intestinal obstruction, uremia, acute pancreatitis.

DURATION

In the fatal cases, death occurs within fifteen days, sometimes within a few hours. Favorable cases may persist for several weeks before recovery is complete.

PROGNOSIS

It is much better since cases are recognized earlier and appropriate treatment is instituted promptly: it is grave otherwise. Cases of moderate degree recover rapidly under treatment, while no doubt many others recover spontaneously, unrecognized.

TREATMENT

It would appear from experimental evidence that the toxemia associated with acute dilatation of the stomach is due to the absorption of toxic bodies absorbed from the obstructed duodenum, which are not absorbed under normal conditions. Obviously, the frequent gastric lavage would at once reduce the dilatation and weight, and remove the toxins from the stomach and dilated duodenum. The postural treatment of Schnitzler, the abdominal, or knee-chest position, would tend to relieve the duodenal occlusion by relieving the downward traction of the mesentery and the weight of the dilated stomach. Dragstedt observed that this type of toxemia, produced experimentally in dogs, can be successfully controlled by the frequent administration of Ringer's solution (Ringer's solution being a solution of varying percentage of sodium, potas-

sium, and calcium chlorid, used to keep the mammalian heart beating in physiologic experiments, intravenously or by hypodermoclysis), and suggests this treatment in clinical cases, as a means of controlling the dehydration which is present to a marked degree, and in addition tending to dilute and promote excretion of toxic materials in the blood.

No food or drink by the mouth, rectal feeding, saline enemas or drip.

Gastro-enterostomy cannot be relied upon, as cases of acute dilatation of the stomach have been reported following gastro-jejunostomy, and gastro-duodenostomy, and the incidence of general narcosis as an etiological factor must be considered.

Carlson has suggested the use of the duodenal tube as a means of removing toxic products from the duodenum. Physostigmina, pituitrin, and strychnine have been advocated as a means of overcoming the muscular relaxation of the stomach and duodenal wall.

CAUSE OF DEATH

The subject of high intestinal obstruction has been studied in experiments by Draper, Hartwell and Hagnet, Whipple and others. Draper concluded that there was a definite form of high duodenal obstruction which resulted in death from a chemical cause. Hartwell and Hagnet concluded that death is not due to bacterial infection. Whipple believes that a toxic proteose is the lethal agent. Hartwell maintains that the toxins isolated by other authors arise from injury to the intestinal wall. The cardinal point is that death is a chemical one. Dragstedt states: "In those experiments (for high intestinal obstruction) it was demonstrated that the toxic materials, which in the event of an acute high obstruction entered the blood stream and caused a sudden and fatal toxemia, had their origin in the intes-

tinal tract as a result of the activity of proteolytic intestinal bacteria. They are *not* absorbed through the normal intestinal mucosa, but *are* absorbed when the blood supply to the intestinal wall has been disturbed by great distention."

AUTOPSY

Connors, in his study of sixty-nine autopsies, states that "the most noteworthy feature in the postmortem picture is the enormous size of the stomach," and again, "A part or whole of the duodenum was found dilated. In the thirty-eight cases in which the duodenum was dilated, the dilatation stopped abruptly near the lower end of the duodenum where it passes behind the root of the mesentery, and a definite obstruction existed there by the pinching of the gut between the mesentery and its contained superior mesenteric artery in front, and the aorta and vertebral column behind. In eight cases there was dilatation of the duodenum, but no compression by the mesenteric artery was noticed."

Often no pathology other than the enormous dilatation of the stomach is noticed.

The stomach is usually white or gray, and is extremely atonic.

Gangrene of cardia is reported in one case (Finsterer).

Veins distended, congested (Finsterer).

One case (Steinman) transverse tear 7 cm. long in the posterior wall of the stomach, due to rupture from over-distention.

H. Campbell Thompson says, "In the majority of cases there are no signs after death of any obstruction of the pylorus or intestines below."

(Connors) Definite obstruction of the pylorus was found only three times; once by a tumor (Thompson), in one case it was due to a band of mesentery (Riedel), and once the obstruction resulted from adhesions (Riedel).

EDITORIAL

M. J. HUBENY, M.D. Editor
EDWARD W. ROWE, M.D. . . . } Associate Editors
BENJAMIN H. ORNDOFF, M.D. . . }

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PROSPECT AND RETROSPECT

My copy of *RADIOLOGY* has come to hand each month with unfailing punctuality. I look forward to seeing it, and my only complaint is that there is so much good reading matter in it that it takes more time than can be spared. I need hardly tell how greatly I appreciate receiving it, and I hereby express my gratitude—gratitude being, it is said, a lively sense of favors to come!

There lies at my side, as I write, the first volume of "The Archives of Skiagraphy," which changed its name in its second year to "The Archives of the Roentgen Ray," and is now the "British Journal of Radiology." The Preface is dated April 2, 1896, less than five months after Roentgen's great discovery, or recognition of the fact that X-rays as well as cathode rays were being produced wherever the Crookes' tube was being used. The first illustration in the volume is a full size reproduction of the head, thorax, arms and abdomen of a three-months child that would not disgrace even the present day *RADIOLOGY*. True, the child was dead and the exposure was fourteen minutes. I believe it was one of the first results of (Sir) Herbert Jackson's modification of the Crookes' tube, the focussing of the cathode stream onto a target, a device that Crookes himself had used in 1879 (British Association Meeting), and by which he had heated to incandescence a piece of platinum placed in the focus of the cathode rays. You also see a picture of the apparatus with which the radiograph was made, and you shudder to think of the risks unwittingly taken by

those early observers. The illustrations are all bone cases, of course, but it is interesting to see some reproduced as negatives, others as positives. There is also a skiagram of the chest of an adult man, showing the heart, etc., fairly well. The exposure, however, is not given, but in his text, Dr. John Macintyre, of Glasgow, tells how he had replaced his platinum trembler brake by a mercury jet interrupter and how he had made distinct pictures of hands with one contact of the blades, one flash, and that some of his best hand pictures were taken with ten flashes thus produced. Following the same line of thought, he produces a series of five pictures of a frog's leg taken for cinematographic purposes with a single flash exposure for each.

A note at the end of Volume I states that a Skiagraphic Society has been formed in London—the birth of the Roentgen Society—and in Volume II we have the address of the first President, Sylvanus Thompson, and also an article by Dr. W. S. Hedley, both of which are full of interest at the present day, the former on account of the accurate scientific yet "popular" picture which he gave of the subject of the new radiations. Of the discovery itself, he says, "Fortunate the discovery may well be deemed, but not fortuitous." In Hedley's paper we get the best historical outline I know of the physics and experiments that led up to the discovery, and also an abstract of what had already been done in the first year in application to medical science. After discussing urinary calculi, chest diagnosis, etc. (1896!), there comes a final column on X-ray therapy, beginning with a paragraph on whether or not there is such a thing as X-ray dermatitis or whether the skin effects observed are the results of heat or some factor other than the rays themselves. Epilation is described: "It may be expected, there-

fore, that when the capillary vessels have recovered their tone, the hair will begin to grow again." Cancer of the stomach has been treated: "An absolute disappearance of the pain, and a diminution of the size of the stomach." A hairy pigmented nevus has been treated with séances of two hours daily! After the eleventh day the hairs began to fall out and eight days later a dermatitis appeared. The observer therefore considers the effects of the rays cumulative in their action. Yes, those were indeed days of discovery, and since you ask me for criticism and suggestions for RADIOLOGY, I would suggest to you and my fellow members that the science of radiology has now a past—it has achieved its majority some years back and is no longer a babe—and there is nothing like a look back into history for getting hold of perspective, especially in these days when it seems that the whole world is so busy that it has not time to think.

What is happening in radiology is that everyone is writing such a lot that he has hardly time to read his own productions, let alone think about what the next fellow has written, even if he reads it. This is, of course, gross exaggeration, but it contains more than an element of truth, and in both congresses and journals you will often find the same substance repeated in different language.

And then, just to assure myself that I am not writing foolishly, I find lying under my left hand the July number of RADIOLOGY. I turn through the pages and my generalization is refuted, for I find there is not a single article that is not just about as good as it can be, and there is not one that is written for the sake of writing! Each one of these articles is worth its place in any journal, and what pleases me so much about this number is the fact that by including an address on Cancer in Relation to Heredity, you recognize radiology, not as an entity in itself, but as a branch of the much greater art of medicine as a whole. I would like to see in RADIOLOGY, as in all X-ray journals, papers by

physicians of standing giving the clinical pictures that we do not obtain in X-ray departments, and possibly also clinical criticisms of our radiological interpretations. It is comparatively easy for us to turn out a nice picture, give it a little dogmatic letter press which may, we hope, be correct, but in which we are probably far more often inaccurate than discovered to be so. Take, for instance, a chest case seen last week in which all the radiological conditions were perfect and a definite negative report could most certainly be given, and yet I learn that the patient has had some wasting, sweating and cough for three months and that she has plenty of tubercle bacilli in her sputum! No, we radiologists do not know everything, and if we are to progress we must keep in closer and closer touch with clinical medicine, surgery and pathology. If RADIOLOGY, or any other X-ray journal, fulfills this office for us, it will be a great step in the right direction, and may perchance save us the penance of wading through the indices of one or two ordinary medical journals each week.

It is, of course, a *sine qua non* that the radiologist shall be in touch with progress in his science, but it is even more important that he shall not grow rusty in his medical knowledge and clinical acumen. The responsibility for the treatment, operative or otherwise, is thrown on the radiologist to an increasing extent, and quite frequently the X-ray report is the only side of the evidence that really counts in weighing up the procedure to be adopted. The radiologist is more and more the jackal of the surgical lion, and in point of fact, it is often our decision which determines whether an operation is undertaken or not. Some radiologists almost make a boast that they do not consider the clinical side of the case at all, and I hold very strongly that this is an utterly wrong position to take. A case is before me now of a girl who has the most extraordinary history—she states that the bowels cannot be moved and, in fact, that on one occasion she had no motion for two months, the last month of

which was devoted to every kind of aperient and enema. The examination shows, up to the present, some deformity of the duodenum, a rather large cecum, and the colon outlined to the transverse portion. When one considers the history one looks at the case in a different light and one's suspicions are all on edge, with the result that one notes that, although she states that the bowels have not been moved, yet, although she has had a second meal, the mass in the right iliac fossa is not correspondingly increased. I strongly suspect that when next I see this patient I shall find a further diminution or possible disappearance of the fecal shadow and a history that the bowels have not acted. In fact, the history, which took a considerable time to extract, and the general clinical appearance of the patient have made me examine in such a way that I am certain that I am on the track of the true condition—one of those weird cases of hysteria in which the patient will inflict untold suffering on herself by the voluntary repression and hiding of defecation. The constant purgatives have produced a bad colitis, and the patient is so weak that, she says, she cannot stand, and has to be carried in. By sheer will power one can easily make her stand, however, and muscle tests, lying down, show the legs and abdominal muscles quite strong enough for the purpose of walking, although she has been in bed six weeks. I quote this case, in which my conclusions are as yet unproved, as one of those in which our responsibility goes a long way beyond our mere X-ray examination, and in which a casual report might lead to an operation which would almost certainly result in confirming this young university student in her invalid life. After all, and no matter how much we magnify their importance, our arts are only a branch of the profession of medicine whose function it is to deal with the problems of the diagnosis and treatment of patients. And patients are just human beings like ourselves: in spite of all our science they persist in being individuals and breaking the bonds

of the scientific shackles with which we attempt to make the art of healing into a science. If it were not thus, well, for me at least, medicine would no longer hold any fascination, for I should feel that, sooner or later, it would be a matter of placing a nickel in a slot with a smear of blood from the ear or toe of the patient, pressing the right button and obtaining an accurately machined diagnosis, prognosis and prescription. Perhaps medicine would be more scientific on these lines, but, when my time comes, I trust I will find one of those antique bipeds who still cherishes the traditional art of healing and appreciates the fact that patients are not ciphers that fit into formulæ, but humans like themselves.

May RADIOLOGY and the science it represents flourish, but, in our science, let us not forget the gentle art of healing.

A. E. BARCLAY, M.D.,

President of the Roentgen Society, London

COMMITTEE REPORT

REPORT OF THE JOINT COMMITTEE OF THE AMERICAN MEDICAL ASSOCIATION, THE AMERICAN CHEMICAL SOCIETY AND THE AMERICAN ASSOCIATION OF PATHOLOGISTS AND BACTERIOLOGISTS, ADOPTED BY THE HOUSE OF DELEGATES AT THE JUNE, 1924, SESSION

"In proposing the following specific recommendations concerning the regulation of clinical laboratories, the Joint Committee of the American Medical Association, the American Chemical Society and the American Association of Pathologists and Bacteriologists wishes to emphasize the importance of encouraging and insuring the adequate education of every laboratory worker in the fundamental sciences which he applies. A clinical laboratory, as that term is used by the committee, is an institution organized for the practical application of one or more of the fundamental sciences by the use of specialized apparatus, equipment and methods for the purpose of ascertaining the presence, progress and source of disease.

"It is the unanimous judgment of the committee—

"1. That it should be illegal for any person not licensed by law so to do, to assume the responsibility of making the diagnosis or of deciding on the progress or source of disease on the basis of any results of a chemical, pathologic, serologic, bacteriologic, radiologic or microscopic observation or other laboratory examinations undertaken; and that where laws do not now restrict diagnosis or the clinical interpretation of laboratory examinations to licensed classes of medical practitioners, laws should be enacted to effect that end.

"2. That any law providing for the licensing of professional workers in laboratories devoted to ascertaining the presence, progress or source of disease should provide for the examination of members of each profession by competent authorities belonging to the same profession.

"3. That as long as an organization or individual engaged in examinations to ascertain the presence, source or progress of disease refrains from all diagnostic and prognostic interpretation of the results of such laboratory tests as provided for in Paragraph 1, any effort to force such organization or individual to place itself under the direction of a representative of any other profession is to be deprecated.

"4. That the American Chemical Society, the American Medical Association, and the American Association of Pathologists and Bacteriologists should co-operate to establish the principles enumerated in the foregoing resolution whenever legislation in this field may be proposed, and that the co-operation of other national bodies should be solicited.

"5. That clinical laboratories be standardized in accordance with the principles laid down in the preceding paragraphs, and legislation should be enacted to insure competent personnel and suitable equipment."

The Joint Committee of the American Medical Association is to be complimented on the above report. However, Paragraph I of this report might have been made a little more specific, as far as radiology is concerned, by making it illegal for any person, not licensed by law so to do, to assume the responsibility of attempting to interpret radiographic and radiosopic findings in terms of pathology. As worded, this Paragraph is misleading, unless the intention was to deliberately leave out of consideration the above-mentioned point. It seems to me just as important to stop the present

indiscriminate pretension of unqualified individuals to make radiographic and radiosopic interpretations which, though they may not be technically regarded as diagnoses, certainly have much to do with influencing many physicians in their opinions of a given case and too often lead to injustice to the patient.

A. U. DESJARDINS, M.D.

DR. W. H. B. AIKINS: IN MEMORIAM

On October 2, 1924, the medical world lost one of its notable leaders in the passing of Dr. W. H. B. Aikins, of Toronto, Canada. Dr. Aikins was Canadian born and educated at Upper Canada College, the University of Toronto, and Victoria University, following which thorough preparation for his career he spent two years in post-graduate work in the medical centers of Great Britain and the Continent. Since 1883 he had practised medicine in Toronto, becoming widely known as a specialist in the study of cancer and the application of radiotherapy to it. For the past three years Dr. Aikins had been a member of the Radiological Society of North America. He was one of the organizers of the American Radium Society, of which he was an early President. He was also a member of the Ontario Medical Association, the Canadian Medical Association, and the British Medical Association, as well as a Fellow of the American College of Physicians and of the Royal Canadian Institute. He was one of the proprietors and editors of *The Canadian Practitioner*, and made many contributions to medical literature, particularly on the subjects of cancer and radium. Of the use of the latter he was one of the first students, and had at his command a relatively considerable quantity of the element. Dr. Aikins was for the period of his practice in Toronto consultant and staff member of the leading hospitals, and on frequent occasions represented Canada in European medical congresses. The only holidays which he permitted himself were spent where he might still further pursue the study of his specialty.

Dr. Aikins' death was due to angina pectoris, a premonitory attack having preceded the fatal one by a week. However, he had not relaxed his attendance upon his patients, and the end came during his afternoon office hours.

A friend, Dr. Edmund King, former President of the Toronto Academy of Medicine, says of Dr. Aikins: "He was a great friend of the young physician and a person to whom medical men went very often for advice, which was always cheerfully given after careful thought."

THE COMMERCIAL EXHIBIT

You all know our commercial exhibitors,
To them you should be frequent visitors;
They show you the latest in their line,
And help our meetings every time.

It is generally recognized that displays of apparatus and accessories such as are to be found in the Commercial Exhibit at our meetings are of marked and distinct educational value to all who visit them.

Because of this great practical value we urge all who attend the Kansas City meeting to visit the Commercial Exhibit at every opportunity and get into direct contact with the exhibitors and their attendants in charge. All the leading manufacturers of X-ray apparatus are represented and have exhibits. Ask them questions, get them to show you and explain to you the various points of superiority that they claim for their lines. Each firm has something that it is particularly proud of. Ask to see it.

The Commercial Exhibit at the Kansas City meeting will be held in the Elizabethan and Blue rooms and adjoining corridors in the Baltimore Hotel. These are adjacent to the registration and railroad desks and to the rooms where the scientific sessions and the Scientific Exhibits are to be held.

The Acme-International X-Ray Co. will occupy exhibit spaces Numbers 33 to 36, inclusive, and will show their 210 KV. generator for radiography and deep therapy, their Water-Oil-Water Cooling System for

the water-cooled therapy tube, their 300 KV. deep therapy tube stand and protective cylinder. They will also exhibit a new Sixty Generator of 100 KV., 60 M.A., capacity, their Radio Knife and the Polytherm High Frequency Generator.

George W. Brady & Co. will exhibit in Spaces 40 and 41 a new Bucky Diaphragm with electric attachment for making the exposures automatically, also some new and novel dental film developing holders and examining accessories. They will also show the Granger Mastoid Localizer, Sphenoid Mask and the new (flat) head Bucky Diaphragm. George will be there to tell you all about it.

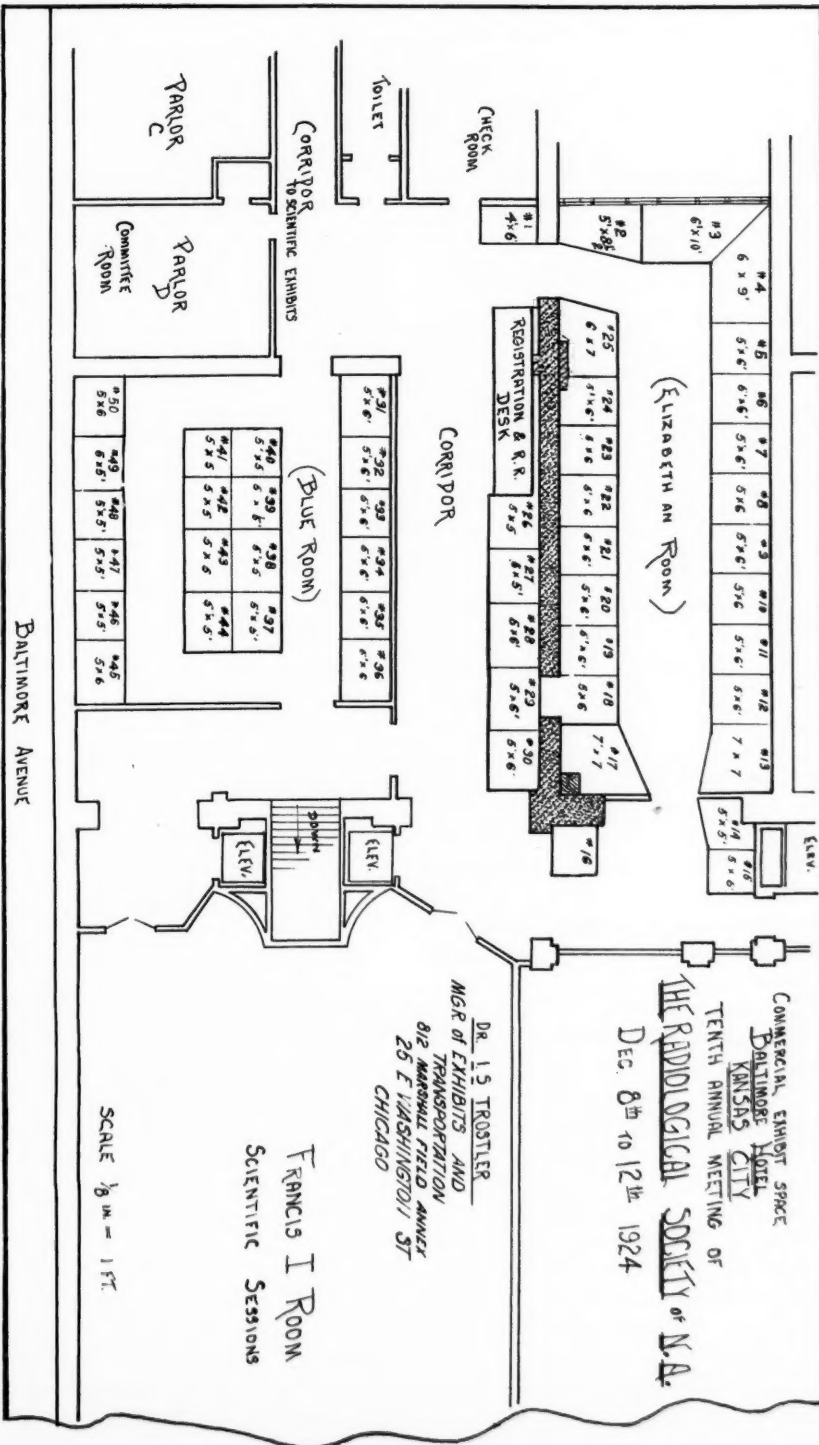
The Buck X-Ograph Co., of St. Louis, will exhibit in space Number 31 the X-Ograph Pneumatic Cassette, Ultra-Rapid Durable Intensifying Screens, Angle Meters, Developing Chemicals, etc., in addition to the well-known X-Ograph Dental Film Packets. Mr. Buck will be glad to meet you there.

The Burdick Cabinet Company, of Milton, Wis., will exhibit Burdick Mercury Vapor Lamps for the production of ultra-violet radiations, infra-red generating apparatus, therapeutic lamps, etc., in space Number 32.

The Eastman Kodak Company will occupy spaces Numbers 3 and 4 and will exhibit a highly interesting series of photographs, radiograms, and photographic apparatus. A visit to this exhibit always pays.

In space Number 10 will be found Henry P. Engeln and E. O. Ries, of the Engeln Electric Company, who will be glad to greet old friends and to show those attending the meeting the new line of Engeln Diathermy apparatus and also the modified Engeln Mobile Unit. Henry has a surprise in store for those who visit this booth.

Space Number 2 will be occupied by the French Screen Company, of Detroit, where they will show their line of French Intensifying Screens along with a series of films showing the results of the work done with and without these screens. Their screens carry a three-year guarantee.



FLOOR PLAN OF COMMERCIAL EXHIBITS, KANSAS CITY MEETING, DECEMBER 8-12, 1924

In space Number 26 the Hanovia Chemical & Mfg. Co. will exhibit their line of Quartz Lamps: the Alpine Sun, Kromayer and the Luxor. These lamps have the entire quartz mercury anode type of burners, which are made by the Hanovia Company in their own plant, the pioneers in this therapeutic field in America. Physicians attending are cordially invited to make this booth their headquarters during the meeting.

Hettinger Bros. Mfg. Co., of Kansas City, will occupy space Number 43 and will show a general line of X-ray apparatus and accessories. They handle the Wappler line of apparatus in Kansas City.

The Horlick's Malted Milk Company will occupy space Number 16 and will exhibit films of the gastro-intestinal tract in which Horlick's Malted Milk was used for the suspension medium. They will also dispense samples of malted milk powder and tablets. The exhibit will be in charge of Mr. J. H. McDaniels, ably assisted by genial Dr. Hobart.

The Kelley-Koett Manufacturing Company are exhibiting in Spaces 19, 20 and 21 a complete line of new and improved X-ray equipment including the pendulum type Plate Changer, Motor Driven Tilt Fluoroscope, new type Stereoscope and many other interesting articles. Mr. J. Robert Kelley (better known as "Bob") will personally be in charge of this exhibit, assisted by his associate, Dr. C. F. Dick, of St. Louis.

The Liebel-Flarsheim Company, of Cincinnati, in Spaces 27 and 28, will show their model "P" Dynelectron, their portable unit, which delivers diathermy up to 4,000 M.A. and electro-coagulation strong enough for heavy work; also the Hugh H. Young Combined Examining, Operating and X-ray G. U. Table, upon which the tube stand is fastened, making it possible to take radiograms in any position, as the tube stand is always centered. When used for operating, the tube stand can be easily removed.

The Middle West Laboratories, of Chicago, will, in space Number 1, exhibit their

Basal Metabolism apparatus and give demonstrations of the methods of its use. The exhibit will be in charge of Dr. Horry Jones.

In space Number 17 the Patterson Screen Company, of Towanda, Pa., will exhibit the Patterson Cleanable Intensifying Screen and the Patterson Fluoroscopic Screen. In addition to these, the new Patterson Foreign Body Fluoroscope will be displayed, together with the other Fluoroscopic Specialties. The exhibit will be in charge of Messrs. Patterson and Reuter.

In space Number 38 the Radiological Review Publishing Company, publishers of the new magazine, *The Radiological Review*, for the general practitioner, will distribute sample copies of their publication together with literature describing the methods to be used to help spread the gospel of Radiology in any particular territory.

The Radium Chemical Company, of Pittsburgh, will occupy space Number 25, and have on display all the latest instruments, screens, etc., used in the application of radium or radon (radium emanation). Members of the Departments of Physics and Medicine will be on hand to explain their use.

In space Number 10 the Radium Emanation Corporation, of New York, will have on exhibit a complete line of their service instruments incorporating the revolutionary "loading slot" for intra-tumoral implantation of bare tubes. They will also have special instruments for undulatory intra-tumor irradiation with the proper screens as used in present-day practice. Reprints, brochures and catalogs will also be available at their booth.

The Standard X-ray Company's exhibit in spaces Numbers 29 and 30 will be in charge of Mr. William G. Hettich. The new Double Disc Rectifier, using the Ionized Air System of High Tension Contacts, along with the latest improvements in the manufacture of high powered X-ray machinery, will be a part of the exhibit of the Standard X-ray Company. Other new

Standard apparatus of interest to radiologists will be shown.

The Victor Corporation will exhibit, in Spaces 5, 6, 7, 8 and 9, their Coolidge Water-cooled Deep Therapy Tube and Cooling System, Balanced Cassette Changer for Stereo-roentgenography of the Chest, Non-abrasion X-ray films, Raygraph—a new product for X-ray diagnosis, Victor-Bolin Dental X-ray Film, Victor-Granger Head and Sinus Rest, Quartz Lamps—an entirely new and improved line, both air-cooled and water-cooled, Victor-Sigmond Galvanic Controller, and other apparatus.

The Wappler Electric Company will, in Spaces 37 and 44, display their well-known

line of apparatus with such new additions thereto as they have recently produced. Of course, Bill Dodge will be on the job.

The exhibit of Cameron's Surgical Specialty Company, Chicago, in space Number 24, will be of interest to every progressive medical practitioner. There complete clinical demonstrations of the value of transillumination, direct illumination and the electro-cautery as applied to all phases of minor and major diagnosis, operative and therapeutic procedure, will be given daily throughout the meeting by trained diagnostic clinicians.

I. S. TROSTLER, M.D.

RADIUM AND ITS THERAPEUTIC USES

Believing that the rapid and successful growth of the Radiological Society of North America warrants the expansion of its official journal, RADIOLOGY, it has been decided to enhance the value of the journal by including articles and abstracts on radium and its therapeutic uses.

Dr. Joseph Muir has consented to write a series of twelve papers, one for each monthly issue, starting with the January issue of 1925 and continuing for the entire year.

This series will deal in an elementary manner with the physics and biological effects of radium, and it is believed will prove to be instructive and entertaining.

The first article will deal with the structure of the atom as a proof conclusive in the nature of the Alpha ray.

The second article will conclude the physics of radio-activity, *i. e.*, the physical properties of the Beta particle and Gamma ray.

The ten articles that will follow after the aforementioned two on physics, will deal naturally with the therapeutics of both the Beta and Gamma rays in their application to the treatment of disease. They will constitute a résumé of the work accomplished to date in the various departments, for example, Gynecology, Urology, Surgery, Dermatology, etc., in this country and abroad.

ABSTRACTS OF CURRENT LITERATURE

Recurrences and skeletal metastases.—This is a study of 36 cases of breast cancer, thoroughly traced by follow-up. Eighty-nine per cent of the cases had axillary involvement prior to operation, which did not deter from operation but called for pre-operative roentgen therapy. Eighty per cent of them had post-operative roentgen therapy, and to date only 30 per cent have recurred. Supra-clavicular metastases were present in 11 per cent, in which cases intensive pre-operative roentgen therapy was given.

Recurrences in the abdominal cavity were not observed in the series, and it is thought that liver metastasis takes place from bone or lung lesions.

Local recurrences in the skin occurred in only 2.8 per cent, and are believed to be due to (1) pre-operative roentgen therapy; (2) wide dissection of the breast; (3) systematic post-operative roentgen therapy.

Skeletal metastases, in order of frequency, were found in the head of the femur, in the ilium, spine, sternum, ribs, skull and lower jaw. Skeletal metastases seem to become well established before any symptoms arise, and pain is the only evidence. It is believed that this type of metastasis is more frequent than is generally supposed, and X-ray examination of the head of the femur, the ilium and the spine should be made in all cases of carcinoma of the breast before operation, as the presence of these bone lesions decidedly alters the prognosis.

It is the author's opinion that roentgen-ray therapy from seven to ten days before operation, and then an intensive post-operative roentgen-ray therapy, giving about 130 per cent of the maximum skin dose over the local area, the glands and also the skeletal bones involved, is, in the light of our present knowledge, the best procedure we have for carcinoma of the breast.

J. B. Lee reports the length of life after recurrence to be six and a half months without irradiation, and two years and four months with post-operative irradiation.

W. W. WATKINS, M.D.

Metastasis in Breast Cancer. W. A. Coventry. *Minn. Med.*, March, 1924, p. 182.

Radiotherapy.—Technic at the Memorial Hospital, New York City, is as follows:

Small carcinomas are treated by special apparatus through the cystoscope, planting bare tubes of radium emanation into base of tumor. If tumor is more papillary, radium is held against

the growth, 300 to 500 mc. for 20 to 30 minutes.

If tumor is larger, suprapubic cystotomy is done and radium seeds planted in the indurated portion, with screened radium packed down upon the tumor and left an appropriate time.

Five cases of prostatic carcinoma, all of whom have been treated more than five years, are reported.

W. W. WATKINS, M.D.

Radium Treatment of Carcinoma of the Bladder and Prostate. B. S. Barringer. *Canadian Practitioner*, March, 1924, p. 147.

Gastrojejunal fistula.—Of fistulous communications between the bowel and stomach due to various causes, 105 cases have been reported up to 1912. The condition follows most frequently after gastro-enterostomy for gastric ulcer, and, although the time of occurrence varies widely, it usually occurs within one year after operation. The writer believes that gastrojejunal ulcers are largely responsible for fistulae, that they are the forerunners of this condition, and that prevention of the one will prevent the other.

The clinical signs are characteristic in a well-developed case. In the majority of instances there are symptoms of gastrojejunal ulcer some time before the clinical manifestations of fistula develop.

One of the most important signs of fistula is fecal vomiting, without other signs of ileus, in a patient who has had previous operation on the stomach. Persistent or periodical diarrhea may occur. One case has been reported where food passed completely through the intestinal tract in from two to three hours.

Another important sign, and one which may clear up the diagnosis even if the condition is not suspected, is provided by X-ray. This method permits the actual visualization of the fistula. It is also important to remember that some fistulae have a valve-like formation at the site of connection, so that a contrast meal may not show the condition, while a barium enema easily discloses the fistula—or the fistula may be seen at certain examinations and not at others. A procedure suggested by Holzknecht is to inflate the rectum with air and to note the rapid increase in size of the stomach bubble.

RÉSUMÉ

1. Gastrocolic and gastrojejunal fistulae have increased in frequency because of the more common surgical treatment of gastric and duodenal ulcers.

2. The prefistulous stage is the gastrojejunal ulcer after operation.

3. Any or all of the manifestations of fistula may be absent, but persistent dyspepsia and diarrhea after operation should lead one to suspect a gastrocolic or gastrojejunal fistula. Radiography in several positions, repeated several times, as well as the various methods of introducing colored substances per rectum and recovering them on washing out the stomach, may establish the diagnosis in doubtful cases.

L. R. SANTE, M.D.

Diagnosis and Treatment of Gastrojejunal Fistula. William A. Brans and Karl A. Meyer. *Surg., Gyn. and Obst.*, May, 1924, p. 646.

Heart and lungs of marathon runners.—

1. The average capacity of the lungs in marathon runners was normal, which indicated that prolonged, vigorous training did not increase the breathing space of the lungs.

2. There was a fall of 17 per cent in the vital capacity immediately following the race, and this returned to normal in twenty-four hours.

3. There was no important relationship between the vital capacity of the lungs and the order in which the runners finished.

4. The size of the heart as determined by the roentgen ray in marathon runners was not enlarged. This indicated that many years of the most vigorous physical effort did not produce cardiac hypertrophy.

5. Immediately following the race, it seems that there was a temporary decrease in heart size, gradually returning to normal in about one day.

6. No "gap" was found in the auscultatory curve of the tracheal artery. The systolic pressure immediately after the race was normal, while the diastolic was distinctly diminished. It is suggested that shortly afterward the systolic pressure fell, whereupon both pressures slowly rose to normal.

L. R. SANTE, M.D.

Observations on a Group of Marathon Runners, with Special Reference to the Circulation. Part I, the Vital Capacity of the Lungs Before and After a Marathon Race. Burgess Gordon, S. A. Levine and A. Wilmaers. *Arch. Int. Med.*, April 15, 1924, p. 425.

Pathology in upper abdomen.—Author describes in general way what can be done toward diagnosing upper abdominal carcinoma, not including lesions of the colon. When a definite filling defect of stomach is found, it is important to decide whether it is malignant or benign. In only a small percentage is it impossible to

differentiate between chronic ulceration and malignancy. Ulcer defect is usually typical and any roughening of its contour should be regarded as suspicious of malignancy. The gastric defects which closely simulate carcinoma, such as tuberculosis, fibromas and syphilis, are rare, and can be excluded by careful examination and history. A negative X-ray examination, if properly and carefully made, practically excludes malignancy.

Malignancies arising outside of the stomach may sometimes be detected by their pressure effects upon the barium-filled stomach.

W. W. WATKINS, M.D.

X-ray Examination of the Upper Abdomen for Malignant Disease. H. M. Tovell. *Canadian Practitioner*, March, 1924, p. 172.

Theory that animals are electro-chemical organisms.—Animals are transformers of energy. It follows, therefore, that animals must be operated by means of one or more of the following six forms of energy: (1) heat, (2) light, (3) gravitation, (4) intermolecular forces, (5) chemical energy, (6) electric energy.

It is obvious that the organism of a rabbit, for example, is not operated by heat energy; nor by light energy; nor by gravitational forces; nor by surface energy. It follows that the probable driving force of animals must be either electrical or chemical energy, or a combination of both. The writer, therefore, proposes the theory that animals are electro-chemical mechanisms. If this theory is tenable it must meet the following requirements:

1. That electricity is a constant phenomenon of living processes. This has long been known.

2. That the application of electricity to the muscles or glands, or to their nerve supply, will cause them to perform their natural functions. This is a basic fact which is universally accepted by physiologists.

3. That the materials of which animals are constructed are specifically adapted to electrical processes. Certain known facts regarding the principal constituents of the body will be cited and new evidence submitted.

4. That in their structure and function the unit cells of the organism are adapted to fabricate, to store, and to discharge electricity. Certain generally accepted facts and certain new evidence which tend to establish this requirement will be offered.

5. That the organism as a whole is a bipolar electric mechanism built on the pattern of the unit cells, the unit cells being constructed on the pattern of the atom. Experimental data which tend to support this requirement will be offered.

6. That the normal and the pathological phenomena of man and animals can be interpreted in electro-chemical terms. Summaries of experimental researches undertaken to establish this point will be given.

CONCLUSIONS

Although the electro-chemical theory interprets well the normal and the pathological phenomena of man and animals; although the numerous predictions based upon this theory have been established by the more exact methods of physics; although it has furnished a plausible suggestion as to the line of evolution from the atom to man; although the theory has stood the crucial test of the surgical clinic by providing a scheme of management which has produced the shockless operation—the theory is not yet proven, and will not be proven until the equivalent of a living cell is constructed; until the equivalent of life is artificially made.

Nevertheless, from previously accepted facts, from clinical observations, and from the evidence of experimental researches in the writer's laboratory of biophysics he concludes:

1. That electric phenomena are co-existent with living phenomena because electricity is detected in every living plant or animal, and is absent in the dead.
2. That electricity is manifested in every act of the living and is probably the so-called "spark of life."
3. That there are great numbers of different kinds of electric circuits in animals.
4. That the source of electricity in the cells is oxidation.
5. That oxidation in the cells of the organism is initiated and governed by electricity.
6. That electricity is accumulated on the lipid films of the trillions of cells.
7. That each of the trillions of cells is a diminutive electro-chemical unit.
8. That during life there is a difference of potential, a state of unbalance within the organism.
9. That death is equilibrium of potential.
10. That there is a universal pattern of the living in the form of bipolarism.
11. That in the non-living, no less than the living, exists the universal pattern of bipolarism.
12. That the pattern of bipolarism runs in continuity from atom to man.
13. That man is an electro-chemical mechanism, a giant ameba climbing up the slippery banks of time.

L. R. SANTE, M.D.

A Biophysical Law Governing Surgical Mortality. George W. Crile. *Surg., Gyn. and Obst.*, April, 1924, p. 431.

Indications for use of radium.—The general practitioner wants definite indications for the choice of radium or surgery in treating tumors of the uterus, because he is called upon to refer them either to the radiologist or the surgeon.

Out of each hundred cases of cervical cancer seeking medical advice, only 40 per cent of them will be operable. Of these 40 cases, 10 per cent will succumb to the operation; of the remaining 36 cases, not more than 25 per cent will be cured by surgery, or nine cases out of each hundred.

Of the inoperable cases treated with radium, 45 per cent are living and well after three years.

In this Clinic at first only the inoperable cases were treated with radium, then the borderline cases, and at the present time all cases of carcinoma of the cervix are treated exclusively with radium and X-ray.

Each case receives a total dose of from 4,000 to 4,800 milligram-hours, divided into two treatments.

Carcinoma of the fundus has, in the past, been treated entirely by surgery, but during the past year there have been three recurrences in the upper end of the vagina, so that the question of radiation in carcinoma of the fundus is now being considered.

In fibroids, radium is not used when the tumor is palpable above the symphysis, or if it is subperitoneal or submucosal, so that accuracy in diagnosis is the prime requisite. Unless future pregnancy is contra-indicated, radiation is not to be used. In the presence of pain, radiation is not the treatment.

In menorrhagia at any age, in fibroids of moderate size without bleeding or other complications, and in cases where surgery is contra-indicated by some complication, radiation is the treatment of choice.

W. W. WATKINS, M.D.

The Role of Radium in Benign and Malignant Tumors of the Uterus. Thomas E. Jones. *Wis. Med. Jour.*, March, 1924, p. 466.

Roentgen-ray therapy for skin lesions.—Roentgen-ray therapy has passed through the stages of extreme optimism, ultra-conservatism and only recently has been placed on a firm basis with the realization that, although its field is wide, it cannot be suitably applied to all diseases, nor to all phases of the same disease.

The application to the following conditions among the eighty skin diseases said by MacKee and Andrews to be amenable to X-rays, is discussed; acne varioliformis and vulgaris, carbuncle and furunculosis, corns and keloids, lupus, onychomycosis, psoriasis, verruca, ecze-

ma. In Hodgkin's disease the entire lymphatic system should be covered. In tonsils and adenoids usually two treatments suffice. In hyperthyroidism, the author uses 120 KV., 5 ma. 30 cm. F.S.D., 4 mm. Al., five minutes through each of three ports, repeated in two, four or six weeks. Basal-cell epithelioma is cured in 85 to 95 per cent of cases, but squamous-cell lesions are not so favorable; a second degree skin reaction extending appreciably beyond the lesion should be sought for. In deep-seated lesions, the author uses 200 KV., 50 cm. F.S.D., 1 mm. copper; the technic is applicable to hemorrhagic metropathies, uterine fibromas, carcinomas of uterus, carcinomas of breast, leukemia and sarcomas.

W. W. WATKINS, M.D.

The Therapeutic Application of the Roentgen Rays. Harold G. F. Edwards. New Orleans Med. and Surg. Jour., July, 1924, p. 11.

Pleurisy of hilum region and pulmonary gangrene.—Pleurisy of the hilum region can be successfully diagnosed only by a combination of a careful history with a roentgenological study. Without a careful history the increased hilum shadow might be interpreted as a mediastinal tumor, glandular masses, or limited pulmonary lesions. Because of the extremely fetid odor, such cases may simulate pulmonary gangrene. However, in pulmonary gangrene, the fetid odor precedes the expectoration, stethoscopic signs are more important, and the general condition is more serious.

L. R. SANTE, M.D.

Pleurisy of the Hilum Region. Harold Swanberg. Surg., Gyn. and Obst., April, 1924, p. 506.

Radiological differentiation between early rickets, late rickets and osteomalacia.—According to evidence brought out by the authors, early rickets, late rickets and osteomalacia are identical conditions. Clinically, histologically, and by metabolic tests, differences found at different ages were insufficient to differentiate the three conditions.

Radiologically, no essential differences were found at different ages. The younger cases showed marked decalcification of the lower end of the bone, so that the bony outline was indistinct. Later the widened epiphyseal line was prominent, with typical cupping as in early rickets, while at the period of complete growth the epiphyseal line disappeared. Thinning of the dense wall of the diaphysis, extension of the cancellous tissue along the shaft, and a coarser, less dense cancellous tissue at the end of the bone were seen at all ages.

Apart from the fact that the widened epiphyseal line depended on the age of the subject, the radiographs were the same at different ages. Severity of decalcification seemed to decrease with increased age in the patient.

The authors conclude that the presence of pregnancy in osteomalacia does not differentiate it, as the symptoms are the same in non-puerperal cases.

As to causal factors of the three conditions, environment is of vast importance. Seclusion, entailing lack of muscular activity (often found in the Orient), is an important factor, as is also lack of sunlight. Pregnancy is of secondary importance as a cause of osteomalacia.

B. C. CUSHWAY, M.D.

On Late Rickets and Osteomalacia, Part II. H. S. Hutchison and Grace Stapleton. Brit. Jour. Child. Dis., April-June, 1924, p. 96.

Multiple myeloma.—Only about seventy-seven cases of multiple myeloma have been reported to date. Another case is added in this report. Numerous small, well-defined areas of bone destruction were present, involving mainly the skull, mandible, sternum and ribs. The extremities were not much involved. The hands and wrist joints showed exostoses and there were urate deposits, possibly from an associated gout. No new bone formation was seen at any place where the tumor broke through the bone.

Experiments on the calcium-phosphorus ratio in the bones showed little, if any, change from normal.

L. R. SANTE, M.D.

An Anatomic and Chemical Report on a Unique Case of Myeloma. A. W. Meyer and F. A. Cajori. Arch. Int. Med., May 15, 1924, p. 581.

Hodgkin's disease.—This discussion is based on observation of 200 cases of Hodgkin's disease treated during seven years at the Memorial Hospital, the records being complete in 164 cases. Palliation only can be expected, although five are living without appreciable symptoms or lesions. There is no other disease requiring, even for palliation, application to so many areas. Radiation is applied only to tumors as they appear, giving careful consideration to the effects upon normal tissues and the general condition of the patient.

In the series of 164 cases, there were 67, or 40 per cent, in which no improvement was appreciable either in local or general symptoms. It is not possible to predict which cases will respond and which will not. Of these 67 failures, 49 were in the terminal stage, while in 18 cases the limited extent of the tumors and general condition of the patients led to the expecta-

tion of good results, but the disease progressed without appreciable palliation.

The location of the tumors made no difference in the response, the superficial, mediastinal and retroperitoneal nodes being equally responsive. However, enlargements of the liver and spleen showed little response. The 97 cases which responded, out of 164, are divided into three groups.

Twenty cases, or 12 per cent of the 164 treated, responded by disappearance of the tumors and symptoms. Five are known to be living, one over four years, three over three years and one six months. Eleven are known to be dead, one of these living over five years, one over four years, two over three years, and seven over two years.

Thirty-four cases, or 20 per cent, responded by disappearance of symptoms but with only partial regression of the tumors. Twenty-nine of these are known to be living, two over six years, one over five years, two over four years, three over three years, and eight over two years. The persistent swellings in some of these cases are evidently only inactive lymph nodes.

Sixty-nine cases, or 42 per cent, responded by partial disappearance of tumors and symptoms. This group includes that disappointing group in which there is an early and satisfactory response, soon followed by a return of the tumors and symptoms.

From the standpoint of palliation, there is no doubt that X-ray and radium constitute a remarkable contribution to the treatment of Hodgkin's disease, but they are only palliative.

Clinically radium has seemed to be superior, but most of the work has been done with X-ray, using the following technic: For superficial nodes, areas 8x8 in., 10 in. dist., 3-4 mm. Al. filter; 9-10 in. s.g., 4-5 ma., time 6-14 minutes. For deep tumors, 12-15 in. dist., 4-5 mm. Al. filter, 4-5 ma., 10 in. s.g., 15-25 minutes. There appears to be no advantage in using higher voltages.

One cycle, including treatment of all involved areas, is usually completed in a week or ten days, and the cycle should not be repeated within six or eight weeks. Too much treatment must not be given at one time—sometimes the application over a single area must be broken into two treatments. The regression begins later than in lymphosarcoma. Generally the first and second cycles will determine the success of the treatment, and careful judgment is required to carry a case through to a successful result.

W. W. WATKINS, M.D.

Treatment of Hodgkin's Disease by the X-ray and Radium, Based upon a Study of 200 Cases. William S. Stone. *Canadian Practitioner*, March, 1924, p. 109.

Cellular and blood changes due to irradiation.—Doses vary with general physical condition of patient and type of malignancy. Breast cases usually receive 150 KV., with $\frac{3}{4}$ mm. copper. Uterine cases receive radium and 200 KV., or more, divided into three to six parts, administered daily or every other day. Long bone malignancies have 200 KV., with 1 mm. copper.

It is believed that direct action of the ray on the cancer cell is responsible for the result. Following irradiation, there follow, in order, diminution in staining intensity, loss of chromatin, homogeneous breakdown of structure into granular, fatty or hydropic products, appearance of fibroblasts and new blood vessels. Swelling and pain following irradiation are due to irritant effect of rays on the small blood vessels, causing exudation of leukocytes and serum.

In the patient there is reduction of carbon dioxide blood plasma and delaying of coagulation time; total leukocyte count is lowered, total non-protein nitrogen in urine and blood is increased, and blood cholesterol increased in advanced cases. There are no noteworthy changes in erythrocytes except after a long series of radiations.

W. W. WATKINS, M.D.

The Effect of Irradiation on Malignancy and Patient. S. S. Marchbanks and T. C. Crowell. *Southern Med. Jour.*, March, 1924, p. 183.

Technic for breast cancer.—Every patient with carcinoma of the breast should be seen by the general practitioner, the radiologist and the surgeon, and the plan of treatment outlined.

Most, if not all, cases of chronic mastitis can be cured by radiation.

The object of pre-operative radiation is to devitalize the cancer cells and to render the tissues less favorable for inoculation. In the low voltage technic successfully used for a number of years, three portals of entry are used. The mid-axillary vertical line is drawn; an anterior horizontal line level with the lower border of the axillary fold divides the anterior region into two areas; a posterior horizontal line level with the spine of scapula gives the lower border of the posterior area. Technic: 6 mm. Al., 9-inch spark gap, 40 cm. focal distance, for 40 minutes. Each of the areas is covered within one week, each application being equivalent to two-thirds of an erythema dose. Each area is again radiated during the second week. The technic with the higher voltages has not been definitely established as yet, the treatment being adapted to the individual case.

In primary carcinoma of the breast, a pre-operative course of X-radiation is recommended,

to be followed in two to four weeks by surgical excision. The course of the pre-operative treatment will require a period of ten days to two weeks. A second course of X-ray treatment should follow the operation. If low voltage rays are used, the second course can be given four to six weeks after the first, and if the high voltage rays are to be used, the second course should not be given inside of two months. Only the two courses of treatment should be given, unless there is evidence of recurrence.

In primary carcinoma of the breast with palpable lymph nodes in the axilla, it is believed that the surgical cures can be doubled by using pre-operative and post-operative radiation. Some inoperable cases can be made operable by radiation. As much care and skill are required for the application of radiation as for the excision by surgery.

W. W. WATKINS, M.D.

Radiation in the Treatment of Carcinoma of the Breast. George E. Pfahler. *Southern Med. Jour.*, March, 1924, p. 203.

Cellular growth in relation to cancer.—

An active independent growth of cells in the body is peculiar alone, under normal conditions, to the earlier periods of development, ceasing as the cells become functionally differentiated.

Cancer represents a return of the property of independent active growth to certain cells or groups of cells in the organism. Growth, differentiation and function are not determined by the cell, but by more general forces or stimuli active in the organism, so that cell division is at all times determined not by forces in the cell, but by the environment of the cell. The shape of cells and their general arrangement in the normal organism, and also in cancer, are related directly to the environment. An active independent growth, *i. e.*, cancer, is merely another form of reaction to environment. The active stimulus for independent growth noted in cancerous and young embryonic tissues is the normal soluble product of the metabolism of the cells. The tissues grow because their cells are crowded together and removed from an active blood supply and are free from the intercellular substance which determines their shape, arrangement and functional activity.

After being misled by the possibility of a parasitic explanation for cancer, which all experiments failed to confirm, the conclusions cited above have been arrived at. The cancer cell is not different from the normal cell, but is a normal cell reacting to a new arrangement of cells in the body. To cure this disease, this mass of cells must be removed or destroyed, or

we must find peculiarity in the growth-reaction of these cells to attack.

W. W. WATKINS, M.D.

Factors Regulating Cellular Growth and Their Importance in the Explanation of Cancer. Montrose T. Burrows. *Southern Med. Jour.*, April, 1924, p. 233.

Heart and thymus in infants.—Two years ago the authors reported their observations upon the heart and thymus in the newborn. The present report includes their observations on the same cases at six months and one year, as well as a series of new cases, including in all 450 observations.

The technic of radiographing the babies was to place them in recumbent position, using double screen, 26-inch distance, 110 ma., at 3½-inch spark gap, one-tenth second exposure.

The heart apparently does not rotate during the first year, but keeps the same shape and position; the increase in size is relatively not so great as the increase in size of the thorax, and the change in apex beat is due to this unequal growth.

There is no relation between the increase in size of the thymus shadow and the increase in the heart shadow. The thymus shadow does not gradually increase or decrease uniformly throughout the first year, but may vary in size at different periods during the first year, and these variations in size may occur without clinical evidence of disease.

W. W. WATKINS, M.D.

Further Observations upon the Shadows of the Thymus and the Heart. L. R. DeBuys and E. C. Samuels. *Southern Med. Jour.*, April, 1924, p. 260.

Pathological processes within the mediastinum.—The lesions arising in the mediastinum may be classified as inflammatory, traumatic or newgrowths. Acute mediastinitis is not detectable until pus forms. Chronic mediastinitis results in distortion or twisting of the structures from fibrous tissue formation. Traumatic lesions result from foreign bodies, fragments of broken bones, mediastinal emphysema. The greatest number of pathological processes within the mediastinum are newgrowths, either benign or malignant. Benign tumors may be of almost any sort, dermoid cyst being most common. Malignant growths are more frequent than benign, sarcoma being more frequent than carcinoma. The lymph glands of the mediastinum may enlarge from inflammatory conditions, such as typhoid, whooping cough, tuberculosis, syphilis or silicosis; from leukemia; lymphadenoma; Hodgkin's disease; lympho-

sarcoma; metastases. The thymus may enlarge from hypertrophy, cyst, sarcoma or carcinoma; substernal thyroids may give rise to tumors; aneurysms and tumors of the heart must also be considered.

In addition to the symptoms and the physical examination, in attempting to locate the structure within the mediastinum involved in the pathology, the X-ray examination is invaluable. Fluoroscopy is more important than radiography, though both should be used. Under the fluoroscope, observation is made from various angles, and the presence and character of movement on respiration and with the heart beat is studied. If there is a mediastinal lesion, the esophagus should be studied with barium paste, since the primary lesion may be in this organ.

A detailed and careful examination, utilizing laboratory procedures, in addition to physical findings and X-ray findings, will result in a definite diagnosis of practically all mediastinal conditions, with the exception of some benign tumors and some nerve tumors.

W. W. WATKINS, M.D.

Disease of the Mediastinum and Its Contents.
Charles E. Hamilton. *Am. Jour. Med. Sci.*,
June, 1924, p. 888.

Multiple polyposis.—Papillary tumors may occur anywhere on the surface, or within the lumen or duct of an organ, and are usually multiple. They may be adenomatous, and when in the gastro-intestinal tract they are spoken of as polypi. Newgrowths of mesodermic tissue or pedunculated skin should not be called polypi. In this type of growth the stroma is sometimes dense and hard from compact fibrous tissue, but may be soft and myxomatous. The proportion of stroma to epithelial elements varies widely. There is reason to believe that the intestinal as well as the cutaneous growths sometimes disappear spontaneously.

Gross appearance of polypi: polypi of the stomach and intestines appear grossly as cauliflower-like growths projecting into the lumen, coarsely or finely lobulated. They are usually soft, reddish or purplish, velvety masses with considerable variation in form and consistency, often ulcerated and covered with inflammatory exudate.

Order of frequency of occurrence as found in cases reported in the literature:

Stomach	4
Cecum to rectum	3
Rectum and sigmoid	2
Hepatic flexure and small intestines.....	1
Small intestines	1
Transverse colon, splenic flexure and descending colon	1
Descending colon and sigmoid	1

Roentgenologic examination was made in 16 cases. Five had lesions of the rectosigmoid; two, chronic ulcerative colitis; two, multiple diverticulitis of the sigmoid and descending colon with a filling defect in the sigmoid flexure; one, gastric polyposis; one, gastrojejunal ulcer, and one, intestinal stasis with obstruction. Roentgenograms of the colon were negative in four. The findings in this series of cases confirm the previous opinion that multiple polyposis, whether in the stomach, colon or rectum, is a diffuse process.

They often stain more deeply than normal glands. Obstruction to glands may result in epithelial lined spaces and cystic areas, which, in turn, may have ingrowths of epithelium to form daughter papillae. The glands are imbedded in connective tissue stroma and carry blood vessels. Such polypi often become malignant.

CONCLUSIONS

1. Multiple polyposis of the intestinal tract is a serious disease from the standpoint of morbidity and mortality.

2. The cause of intestinal polyposis is not known, although chronic ulcerative colitis appears to be a prominent factor.

3. There is no specific medical treatment, and operation undoubtedly offers the best results in all cases.

4. The predominant symptoms are diarrhea, with the passage of pus and blood, vague abdominal pain, and rectal tenesmus.

5. Multiple polyposis is a disease of the large intestines and of the stomach. The small intestines are rarely involved.

6. Proctoscopic examination should be made routinely in all cases of dysentery of more than a few days' duration.

7. The roentgen ray is practically the only means of diagnosing multiple polyposis of the stomach, or above reach of the proctoscope in the bowel.

8. The disease terminates in malignancy in a large percentage of cases.

9. Most marked involvement of the colon is found in the cases which begin as a mild diarrhea and later become chronic.

10. The findings in one patient would tend to confirm the correctness of Menetrier's terminology "gastritis polyposis."

L. R. SANTE, M.D.

Multiple Polyposis of the Gastro-intestinal Tract. John E. Struthers. *Surg., Gyn. and Obst.*, May, 1924, p. 610.

PROGRAM OF THE ANNUAL MEETING OF THE RADIOLOGICAL SOCIETY
OF NORTH AMERICA, KANSAS CITY, MO., DECEMBER 8-12, INCLUSIVE

Monday, Dec. 8th

- Executive Session 3:30 P. M.
Dinner, followed by continuation of
Executive Session and Counselors' Meeting 6:30 P. M.

Tuesday, Dec. 9th, morning session, 8 A. M.

Address of welcome—

Response for the Society.

Conference on Radiological

Education 9:30 A. M.

Harold Swanberg, M.D., Quincy, Ill.

"Educating the Practicing Physician as to the Value of Radiology."

James H. Dempster, M.D., Professor of Roentgenology, Detroit College of Medicine Detroit

"Undergraduate Instruction in Radiology."

Clinical Conference on Carcinoma of the Breast.

A consideration of the pathological, surgical, and radiological aspects of the subject, to be conducted by

Burton J. Lee, M.D., Professor of Clinical Surgery, Cornell University, New York City

1. Harry Roswell Wahl, M.D., Professor of Pathology

University of Kansas

"The Effects of X-ray Therapy upon Tissues."

2. Malvern B. Clopton, M.D., Surgeon St. Louis

"Difficulties in the Diagnosis of Cancer of the Breast."

3. Jabez N. Jackson, M.D., Surgeon Kansas City

"Results Obtained in the Surgical Treatment of Cancer of the Breast."

4. John F. McCullough, M.D., Radiologist Pittsburgh

"Results of Radiological Treatment of Cancer of the Breast."

5. Benjamin H. Orndoff, M.D., Professor of Roentgenology, Loyola University Chicago

"Breast Malignancies."

Will discuss the possible biological explanation of tissue reaction to radiation: some undesirable features of radiotherapy. Will offer a technic of procedure which has been most satisfactory and efficient in his experience.

6. A. U. Desjardins, M.D., Radiologist Rochester, Minn.

"Pulmonary Fibrosis Following X-ray Treatment and Diffuse Pulmonary Metastases in Cancer of the Breast."

Abstract: Discussion of so-called pulmonary fibrosis following X-ray treatment in breast cancer, and the conditions under which it is produced: probable explanation of the phenomenon. Discussion of pulmonary metastasis, with special reference to the diffuse lymphangitic type and its differentiation from so-called fibrosis due to X-rays.

Tuesday afternoon session, 1:45 P. M.

Clinical Conference on Bone Tumors, to be conducted by

Henry W. Meyerding, M.D., Professor of Orthopedic Surgery, University of Minnesota

Mayo Clinic, Rochester, Minn.

1. Willis C. Campbell, M.D., Orthopedic Surgeon Memphis, Tenn.

"Bone Syphilis."

2. William C. MacCarthy, M.D., Professor of Pathology, University of Minnesota

Mayo Clinic, Rochester, Minn.

"Types of Bone Tumors."

3. Henry W. Meyerding, M.D.

"Multiple Myeloma."

(3:45 P. M.)

Clinical Conference on Tuberculosis of the Lungs, to be conducted by William Walter Wasson, M.D., Denver, Colo.

1. William Snow Miller, M.D., Professor of Anatomy, University of Wisconsin Madison, Wis.
"Key Points in Lung Structure."

Abstract: In studying the structure of the lung, whether it be from the standpoint of normal histology or of pathological histology, there are five key points which are of material assistance, for, as will be shown, it is at these points that important histological structures are situated and definite anatomical relations can be established.

The five points are as follows:

- (1) The place where radicals of the pulmonary vein arise from the pleura.
- (2) The place where radicals of the pulmonary vein arising from the distal end of ductuli alveolares, joint venous trunks situated on the periphery of the primary lobule.
- (3) The place where radicals of the pulmonary vein arising from the place where bronchi or bronchioli divide, join larger venous trunks, which may or may not be situated on the periphery of a secondary lobule.
- (4) The distal end of ductuli alveolares.
- (5) The place where bronchi or bronchioli divide.

These points will be taken up in detail and illustrated with lantern slides.

2. Henry Kennon Dunham, M.D., Associate Professor of Medicine, University of Cincinnati College of Medicine Cincinnati, Ohio
"The Pathology of Tuberculosis in the Human."
3. James J. Waring, M.D.
Denver, Colo.

"The Relationship of the Radiological Diagnosis of Tuberculosis of

the Lungs to the Clinical Diagnosis."

4. I. S. Trostler, M.D., and Robert H. Hayes, M.D. Chicago
"A Pathognomonic Radiographic Finding in Early Pulmonary Tuberculosis." (Further Report.)
5. William Warner Watkins, M.D., and Harlan Page Mills, M.D.

Phoenix, Ariz.

"The X-ray Evidence of Secondary Infection in Pulmonary Tuberculosis."

Tuesday, Dec. 9th, evening session, 8 P. M.

Joint meeting with the Jackson County Medical Society. Lewis Gregory Cole, M.D., Professor of Roentgenology, Cornell University Medical College, New York City, will release a motion picture film entitled, "The Roentgen Diagnosis, Classification, and Prognosis of Pulmonary Tuberculosis."

Wednesday, Dec. 10th, morning session, 8 A. M.

Clinical Conference on Non-tubercular Diseases of the Lungs, to be conducted by LeRoy R. Sante, M.D.

1. LeRoy R. Sante, M.D., Associate Professor of Radiology, St. Louis University School of Medicine

St. Louis

"Acute Consolidations of the Lung: Their Recognition and Differential Diagnosis."

2. William H. Stewart, M.D., Clinical Professor of Roentgenology, New York Polyclinic Medical School

New York

"Pleural Effusions, General and Local: Their Detection and Differentiation from Lung Abscess."

3. Leon T. LeWald, M.D., Professor of Roentgenology at the University and Bellevue Medical College

New York

"Newgrowths of the Lung, Primary and Secondary: Their Classifications, Characteristics, and Differential Diagnosis."

4. Max Kahn, M.D., and Martin F. Sloan, M.D. Baltimore
"X-ray and Clinical Study of Some Pulmonary Lesions."

Abstract: The roentgen-ray and clinical study of diseases of the lungs can be divided into three groups:

- I. Tuberculous.
- II. Non-tuberculous.
- III. Neoplasms.

I. Incipient tuberculosis is the most difficult of detection and requires the combined skill of the phthysiologist and roentgenologist. Moderately advanced and advanced tuberculosis can be determined fairly and easily by either, but is best studied by both, supplemented by a careful history and laboratory findings. In this manner, the extent of the lesion, the presence or absence of cavitation or pneumothoraces, and the degree of activity may be determined.

II. Non-tuberculous lesions include bronchiectasis, mycotic infections, pneumonia and residual pneumonia, emphysema, foreign bodies, pleurisy with effusion, abscesses of different etiology, bronchiolithiasis, pneumoconiosis and echinococcus cyst. Neoplasms, because of their relative frequency and great importance, are given a separate subdivision.

III. Neoplasms of the lung are primary and secondary in origin. They consist of sarcoma, carcinoma, dermoid cyst and hypernephroma. Sarcoma of the lung is very rarely primary; metastases are fairly frequent from bone and rarely from the breast. Carcinoma of the lung is rarely primary; it metastasizes with relative frequency from the breast, prostate, ovary, etc. Dermoid cyst of the lungs is always primary. Hypernephroma is always metastatic.

Russell D. Carman, M.D., Professor of Roentgenology, University of Minnesota Graduate School of Medicine.

Mayo Clinic, Rochester, Minn.
 and

William F. Braasch, M.D., Professor of Urology, University of Minnesota Graduate School of Medicine

Mayo Clinic, Rochester, Minn.
"The Roentgenologic and Pyelographic Diagnosis of Renal Tumors."

(10:30 A. M.)

Clinical Conference on Radiodontia, to be conducted by

Boyd S. Gardner, D.D.S.

Mayo Clinic, Rochester, Minn.

"Teeth as Foci of Infection."

1. W. W. Duke, M.D. Kansas City
Medical Aspect.
2. Frederick Molt, D.D.S. Chicago
X-ray Diagnosis.
3. R. L. Haden, M.D., Pathologist
 Kansas City
Bacteriological Aspect.
4. Boyd S. Gardner, D.D.S.
 Mayo Clinic, Rochester, Minn.
Surgical Aspect.

Wednesday, Dec. 10th, afternoon session,
 1:45 P. M.

Therapy of Cancer. Conference on
 Physics of X-ray Therapy.

Roy Kegerreis, A.M., Department
 of Physics, University of Michigan
 Ann Arbor, Mich.

"A Portable Apparatus for Measuring X-rays."

Abstract: This apparatus has been designed with portability as a prime consideration, with the also all-important requisite that it should be operable by a person who might not necessarily be conversant with all the details of its design.

It is made in suitcase form with a removable ionization chamber, which is permanently connected to

the rest of the apparatus by means of a long flexible cable. No connections need be made and the manipulations are extremely simple, since there are only three positions for the single operating handle. A unique system of mechanical interlocks has been devised to insure the proper switching off of the various circuits previous to transport.

The quantity of incident radiation is measured, since the meter has an ordinary pointer whose deflections may be noted directly. Effective wave length determinations are possible, according to the penetrometer principle, when filters are employed. The apparatus may be used for checking up photographic or therapy machines. Its weight is forty pounds.

H. N. Beets, Physicist, Michael Reese Hospital Chicago
"A Projection Electroscop for Quantitative and Qualitative X-ray Measurements."

Sanford Withers, M.D. Denver
"Points of Interest in the Operation of Oil-immersed Coolidge Tubes at 200 K.V."

Discussion by Dr. Francis Carter Wood and Mr. Roy Kegerreis.

Bio-physics:

Francis Carter Wood, M.D., Director of the Institute for Cancer Research, Columbia University

New York

"Further Studies in the Effectiveness of Different Wave Lengths of Radiation."

Abstract: It has been shown by laboratory experiments that the lethal dose for a given mouse tumor with unfiltered or filtered X-ray and filtered Gamma rays of radium is always the same multiple of an erythema dose. That is, it takes, for example, five human erythema doses to kill a given mouse tumor

of any type with radiation, no matter what wave length that radiation may have. This shows that the effectiveness of radiation on the tumor and the skin is the same when measured by an erythema, however, a notoriously inaccurate method.

In a paper read at the September meeting of the American Radiological Society it was shown that equal ionization doses of different wave lengths of X-ray were equally effective under certain prescribed conditions. These experiments are now being extended, comparing different types of ionization chambers and a different series of tumors, and the results obtained will be reported.

Ernst A. Pohle, M.D. Cleveland
"A Study of the Velocity of Sedimentation of the Erythrocytes in X-ray Therapy Cases."

Clinical Conference on Cancer of the Uterus, to be conducted by

A. U. Desjardins, M.D.

Mayo Clinic, Rochester, Minn.

Harry H. Bowing

Mayo Clinic, Rochester, Minn.

"A Radiotherapeutic Method of Management in Cases of Carcinoma of the Cervix Uteri."

Daniel T. Quigley, M.D. Omaha
"Etiology, Pathology, and Treatment of Cancer of the Cervix."

Curtis F. Burnam, M.D., and William Neill, Jr. Baltimore

"A Brief Review of the Indications and Technical Procedure Employed by the Authors in Treatment of Cancer of the Uterine Cervix and Body."

Harold C. Bailey, M.D., Associate Professor of Obstetrics and Gynecology, Cornell University Medical College New York

"The Principles of Irradiation Therapy in Cancer of the Uterus."

Wednesday, Dec. 10th, evening session,
8 P. M.

Clinical Conference on Thyrotoxicosis,
to be conducted by E. L. Jenkinson,
M.D. Chicago

Medical Aspect:

Robert B. Preble, M.D., Professor
of Medicine, Northwestern Med-
ical School Chicago

Newell C. Gilbert, M.D., Associate
Professor of Medicine, North-
western Medical School, Chicago

John L. Tierney, M.D., St. Louis

Surgical Aspect:

Edward P. Richardson, M.D.,
Massachusetts General Hospital
Boston

Radiological Aspect:

Arthur C. Christie, M.D., Professor
of Roentgenology, George Wash-
ington School of Medicine
Washington, D. C.

Robert G. Allison, M.D., Associate
Professor of Roentgenology,
University of Minnesota Medical
School Minneapolis

Roland E. Loucks, M.D. Detroit

Thursday, Dec. 11th, morning session,
8 A. M.

Edward H. Kessler, M.D., St. Louis
Adolph Hartung, M.D., Assistant
Professor of Roentgenology, Uni-
versity of Illinois College of Medi-
cine Chicago

"Diverticula of Duodenum."

Samuel B. Childs, M.D., Associate
Professor of Roentgenology, Uni-
versity of Colorado School of Medi-
cine Denver

*"Appendicitis and Lesions Compli-
cating Its Diagnosis: Deductions
from X-ray Determinations."*

Joshua C. Dickinson, M.D.

Tampa, Fla.

*"X-ray Findings in Hepatic Ab-
scesses of Amoebic Type."*

Charles C. Dennie, M.D., Assistant
Professor of Dermatology, Univer-

sity of Kansas School of Medicine
Kansas City

*"Report on Congenital Syphilis of
Bones and Joints."*

Charles G. Sutherland, M.D.

Mayo Clinic, Rochester, Minn.

"Charcot Joints."

Roentgenographic and Orthopedic Clinic.

Cases will be presented illustrating
bone and joint pathology by Preston
M. Hickey, M.D., Professor of Roent-
genology, University of Michigan,
Ann Arbor, Michigan, and Frank D.
Dickson, M.D., Kansas City. In this
clinic cases will be presented illustrat-
ing bone and joint pathology, with
discussion of the X-ray findings by
Dr. Hickey and demonstration of the
clinical features by Dr. Dickson.

Thursday, Dec. 11th, afternoon session,
1:45 P. M.

Conference on Light Therapy.

1. William W. Duke, M.D.

Kansas City

"Light Sensitization."

2. Henry G. Schmitz, M.D., Professor
of Gynecology, Loyola University
School of Medicine Chicago

*"Treatment of Tuberculosis of the
Genito-urinary Organs with Quartz
Light and X-rays."*

3. Axel Reyn, M.D., Head Physician
of Finsen's Mediciniske Lysinstitut
Copenhagen, Denmark

Discussion to be opened by A. J.
Pacini, M.D., Chicago

Conference on Biology and Biophysics
of Cancer.

1. William T. Bovie, Ph.D., Professor
of Biophysics, Harvard University
Cambridge, Mass.

*"The Relation Between Physiological,
Dominant, and the Biological
Effects of Rays."*

2. Montrose T. Burrows, M.D., Asso-
ciate Professor of Experimental
Surgery, Washington University
School of Medicine St. Louis

"Is Cancer a True Disease or Merely the Result of a Condition of Change in the Organism?"

Abstract: The problem which confronts X-ray and radium therapy has to do with the forces active in cancer when it is fully developed. Previous studies have shown that cancer may be induced by any one of a variety of subjects and agents, but these studies have not shown that it itself is due to any of these specifically. Cancer, once induced, proceeds independent of these causative agents. I have found evidence to show that it may be explained as the result of a specific change in the arrangement of the tissue. It is not a disease in the sense of any of the infectious diseases, but belongs in the class with gangrene and atrophy. These various substances and conditions merely act to bring about the establishment of this tissue arrangement. We have analyzed the manner in which coal tar and bacteria produce the cancerous tissue and have thus established facts for ascertaining in a similar manner the action of the X-ray and radium.

3. Maud Slye, Ph.D., Cancer Laboratory, Department of Research, University of Chicago Chicago
"Studies on the Nature of Cancer."

Thursday evening.

Annual Banquet.

Convocation: Presentation of Gold Medals and Honorary Diplomas.

President's Address.

Short Speeches.

Frolic and Dancing.

Friday, Dec. 12th, morning session, 8 A. M.

Conference on Cancer Therapy.

Robert H. Millwee, M.D.

Dallas, Texas

"The Cause of Cancer."

J. Thompson Stevens, M.D.

Montclair, N. J.

"Cancer of the Lip and Its Treatment by Means of the Roentgen Ray, Electrothermic Coagulation, and Radium."

George W. Grier, M.D., Pittsburgh
"Treatment of Malignancy of the Eyeball."

Emil Beck, M.D., North Chicago Hospital Chicago

"Some Interesting Phases in the Treatment of Apparently Hopeless Cases of Sarcoma and Carcinoma."

James F. Percy, M.D., Los Angeles
"The Treatment of Cancer as Taught in American Medical Colleges."

Clinical Conference on the Gall Bladder, to be conducted by B. R. Kirklin, M.D. Muncie, Ind.

Robert A. Arens, M.D., Michael Reese Hospital Chicago

Russell D. Carman, M.D.

Mayo Clinic, Rochester, Minn.

Charles D. Enfield, M.D.

Louisville, Ky.

Bernard H. Nichols, M.D.

Cleveland, O.

"Differential Diagnosis of Gallstones and Kidney Stones."

Friday, Dec. 12th, afternoon session, 1:45 P. M.

Sherwood Moore, M.D., X-ray Department, Washington University

St. Louis

"Radiological Aspect of Certain Bone Marrow Diseases."

Abstract: Rarity of the diseases under discussion. Their incidence. Variation of radiographic findings. An attempt to differentiate the diseases on their findings and to correlate radiographic findings and the clinical course. Remarks on radiotherapeutic treatment.

William E. Costolow, M.S.

Los Angeles

"Radiation Treatment of Bone Tumors."

Jefferson D. Southard, M.D.
Fort Smith, Ark.

"X-ray Treatment of Bone Tuberculosis."

Joseph Colt Bloodgood, M.D., Asso-

ciate Professor of Clinical Surgery,
Johns Hopkins University

Baltimore

"Interpretation of Roentgenograms of Central Lesions of the Lower Jaw."

Ventral tumors of sacrum.—Ventral tumors of the sacrum (so-called Middeldorpf tumors) are definitely encapsulated, are usually attached to the periosteum, and tend to erode the bone. The greatest pressure is exerted on the neural, and not on the rectal side.

Remains of the lower neural canal and the postanal gut appear to form the basis for many of the ventral tumors. There is great diversity of tissue in these growths; all the body tissues may be represented.

Opinion seems about equally divided with regard to the monogerminal and bigerminal theories of origin of these tumors.

Ventral tumors of the sacrum seldom metas-

tasize, but cause death by infiltration. The blood picture is practically always normal, and the urine rarely shows unusual changes. Systemic reaction of the tumors is mild. Pain resembling sciatica, and constipation are often the only symptoms.

The roentgen-ray findings are practically always negative. Treatment consists of the removal or scraping out of the tumor, followed by extensive radium radiation.

L. R. SANTE, M.D.

Ventral Tumors of the Sacrum. Herman W. Hundling. *Surg., Gyn. and Obst.*, April, 1924, p. 518.

FOR SALE

Applicator containing about 5 milligrams radium.

Union Trust Company, Executor,
Washington, D. C.

FOR SALE—X-ray laboratory in Maine city center of 30,000 people. Equipment new within eighteen months costing \$5,000. Death of owner makes immediate sales imperative. A wonderful opportunity for the right man. Address Mrs. T. E. Hardy, 30 Pleasant Street, Waterville, Maine.

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